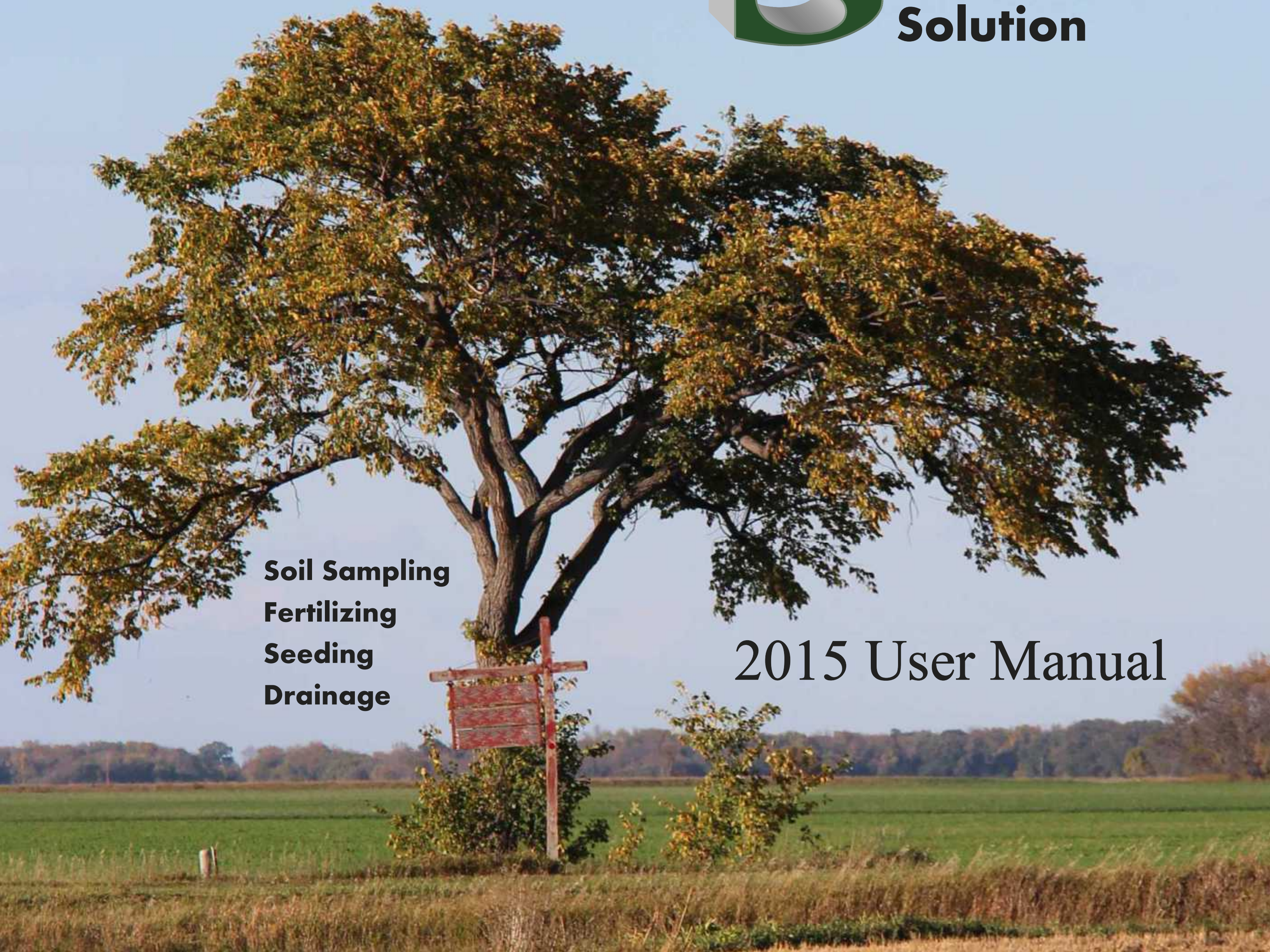
"The"

ADMS

A Ag
D Data
M Mapping
S Solution

GK Technology
For Agriculture



Soil Sampling
Fertilizing
Seeding
Drainage

2015 User Manual

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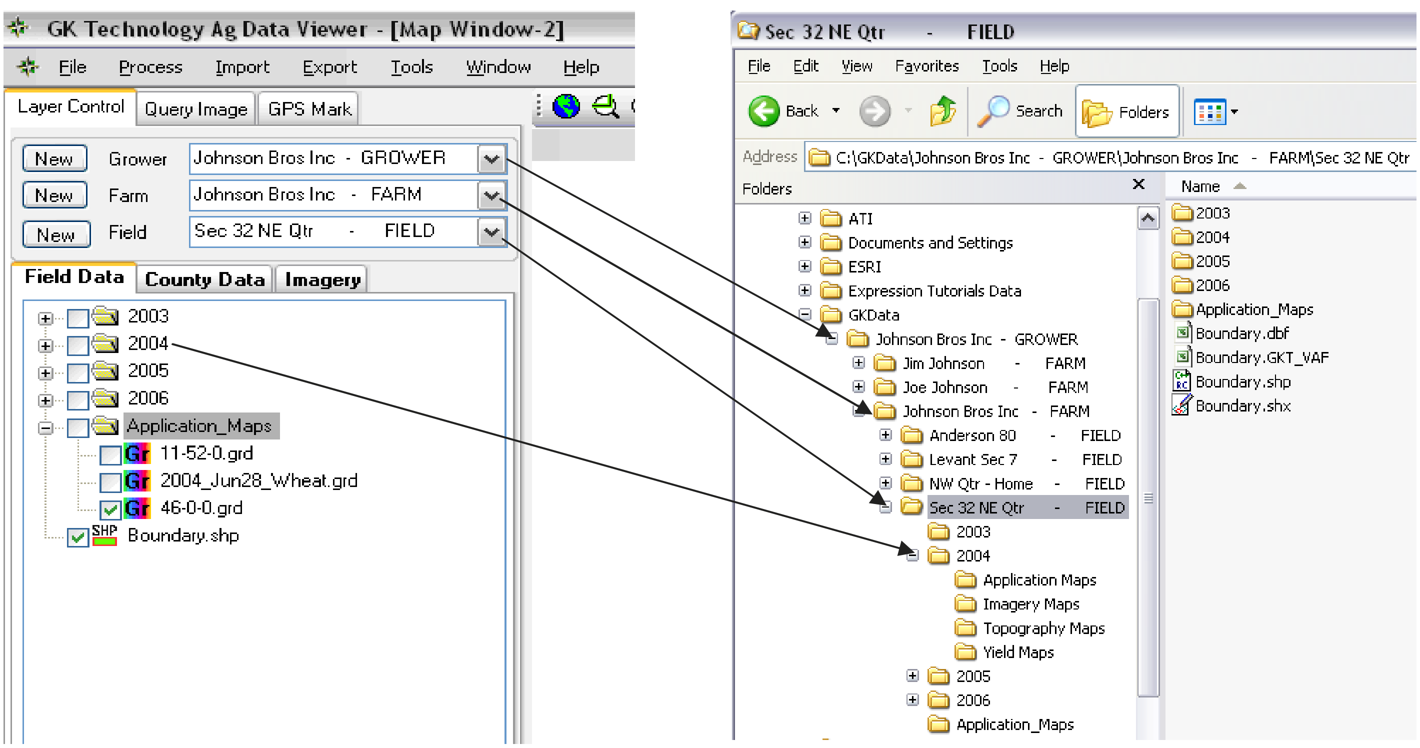
File Storage & Structure Layout

When you open up ADMS you will find that every window has Grower-Farm-Field as drop downs in the upper left corner. This is how to select the field and files to be used. Also, the names located in these drop downs are going to print on the side of most of the maps. Ag Data Mapping Solution software is based on a very simple folder file format. When you go to Windows Explorer to look at your files and folders, the names displayed on the folders in the "GKData" folder are the same seen in Ag Data Mapping Solution. You can name, rename and create folders in either ADMS or Windows Explorer (you may get errors in both windows if you have files open in the folders you are re-naming).

Below is an example of how to build the file structure. If you are a farm with only one (1) entity, then use this structure: (ex. Grower- "Johnson Bros Inc" & "Farm-Johnson Bros Inc" then your Fields). Take note of Field "Sec 32 NE Qtr"; it is populated with folders of years. At the end of each year, place all your data into a completed year folder. Using some sort of file structure similar to the "2004" example (Application, Imagery, Yield and Topography folders). If "Topography" data is only collected every few years, you may want to move that up one level to be stored in the "Field" folder. Only create folders for information that is there, having an empty "Topography" folder stored in a "Year" folder can be confusing. It may make you think data was collected that year when it really was NOT. If the field is farmed as one field year-in and year-out, the "Boundary" file should stay in the "Field" folder. If the field is farmed differently every year, then the "Boundary" should be stored in the "Year" folder. As each project is finished throughout the year, go ahead and create a folder, ex. "Application Maps". Then at the end of the year, create a "2007" folder and move the "Application", "Yield" and "Topography" folders into the "Year" folder. This will make for quicker and more efficient use of ADMS. It also makes it easier to know where all the files are from year to year.

Ag Data Mapping Solution **Windows Explorer**



Getting Started With Ag Data Mapping Solution

To get started with Ag Data Mapping Solution, you need to have some base data in place to work with. You will need some "Properly" geo-referenced piece of data. Meaning that the data sets are in either Latitude / Longitude or UTM projections system using WGS84 or NAD83.

TO GET STARTED YOU NEED AT LEAST 1 OF THESE ITEMS

County Data set for the area you are working (**County Data**—tab)
- NAIP images (USDA-Geospatial)
- DRG images (USDA-Geospatial)
- Soils Maps (USDA-Geospatial)
- Townships & Sections Maps (USDA-Geospatial)
- Roads, Railroads & Water ways (TIGER Data)

Data Set to build Maps—need one or more of these (more is usually better)
- Satellite / Aerial Imagery (**Imagery**—tab)
  - Images USGS
  - Images UMAC
  - Topography from LIDAR
  - Other Imagery sources
- NAIP Images (**County Data**—tab)
- Yield data (Raw Data card or .shp files) (**Field Data**—tab)
- Veris data (Raw Data card or .shp files) (**Field Data**—tab)
- Topography from RTK (Raw Data card or .shp files) (**Field Data**—tab)

Below is a "Rough Outline" of the Process to use this data in the field.

Build - Client / Farm / Field structure in ADMS

Draw <> Collect <> Extract <> Import - Field Boundary

For VRT Mapping

Create Management Zones or Sample Grids

Soil Sample

Set application rates

Enter application values (create prescriptions)

Write prescription to controller

Print "Hard copy" map with total LBS of product

For Topography Mapping

Import & Process topography data

Inspect topography accuracy / outlets

Process watersheds / contours

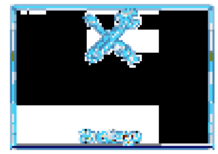
Create surface / tile drainage plan

Create background data sets for controller or infield display

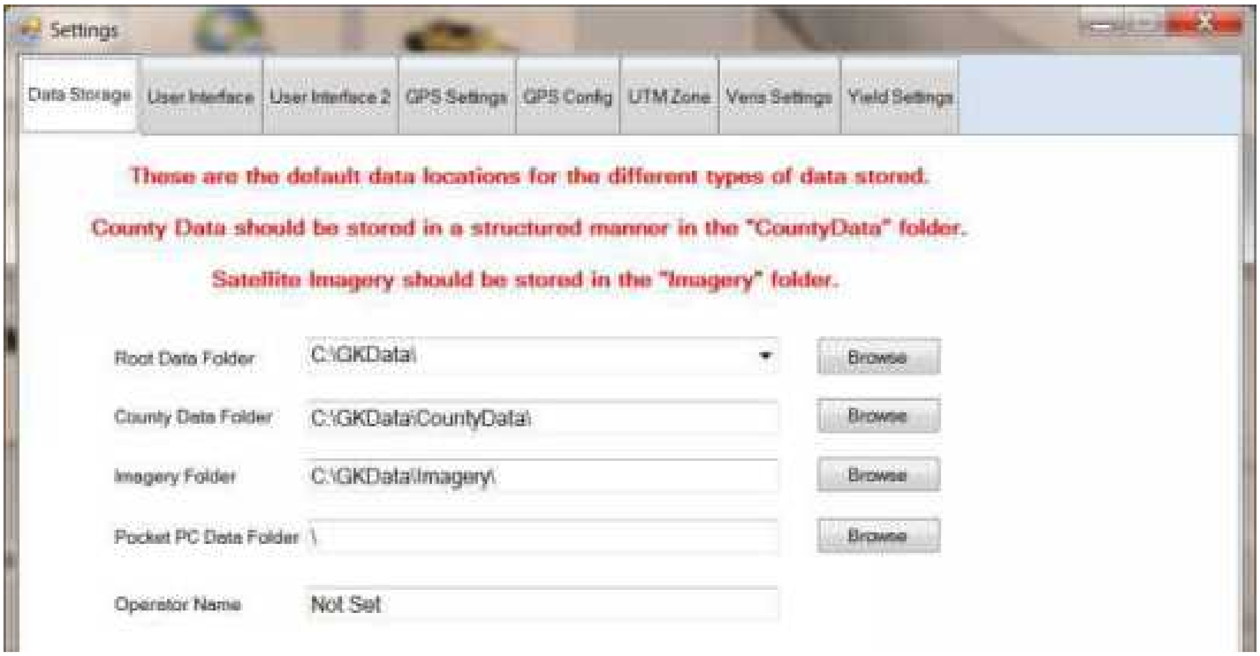
Print "Hard copy" map for taking notes & taking to the field

Settings Window

Data Storage



These next pages will walk you through the base settings for ADMS.



Use the “Browse” button to set the location where the software will look for the different data sets.
Software DEFAULTS are shown above.

Root Data = Grower / Farm / Field data sets and the location of many operating files (color tables, templates, blend groups, scripts and base operating database).

County Data = Location where you store data relative to your County or Region. This data may be roads, sections, townships, soils or county wide images (NAIP). Mostly data downloaded from USDA Geo-Spatial website.

Imagery Data = Location where you store satellite imagery scenes and wide area topography data.

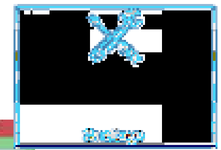
Pocket PC Data Folder = Location where you would have folders for GK Pocket Field Recs or Pocket VR mobile platforms.

Operator Name = users name used for tracking processed data.
NOTE: The name and spaces must be less that 12 characters long.

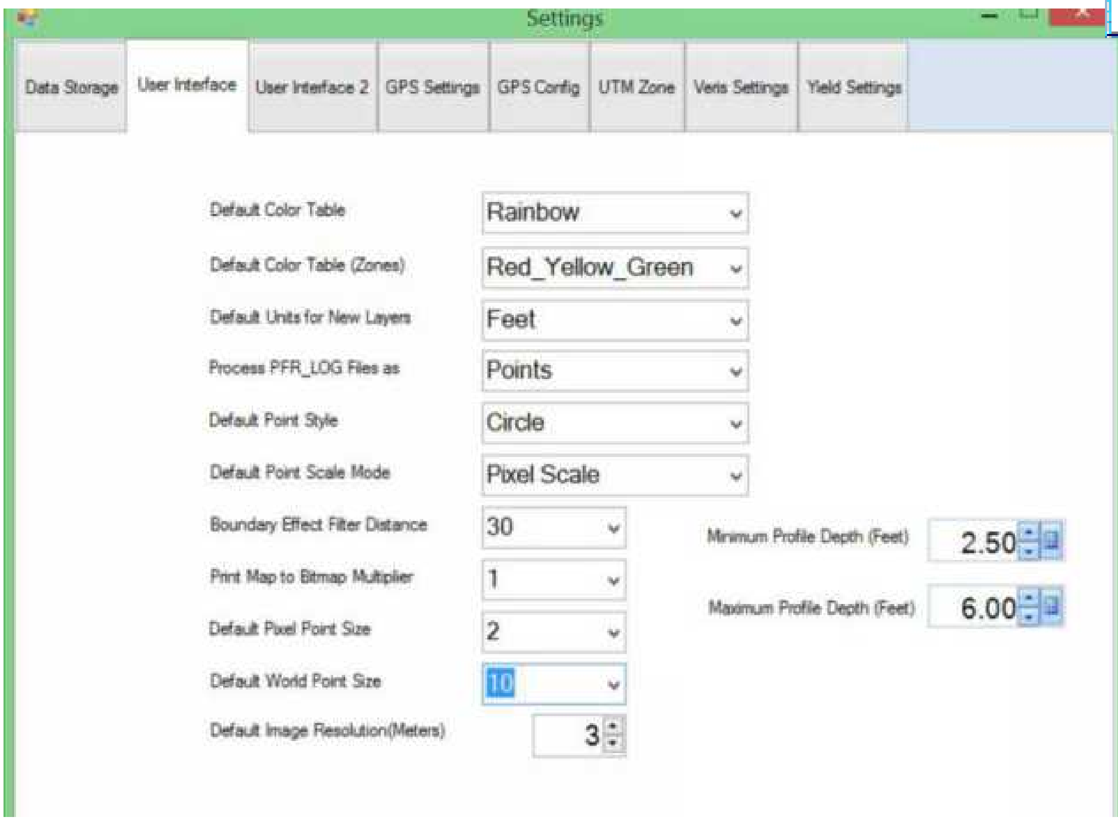
The beauty of ADMS is the ability to run and utilize data sets off of USB devices and your Local disk drives.

Example would be leaving all you Root Data (grower data) on the “C:” drive and running all your County Data off a USB device “D:” or a “Mapped Network Drive”
NOTE: Read / Write speeds may be GREATLY reduced depending on the speed of your device.

Settings Window



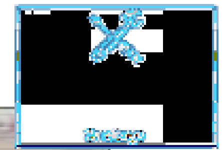
User Interface



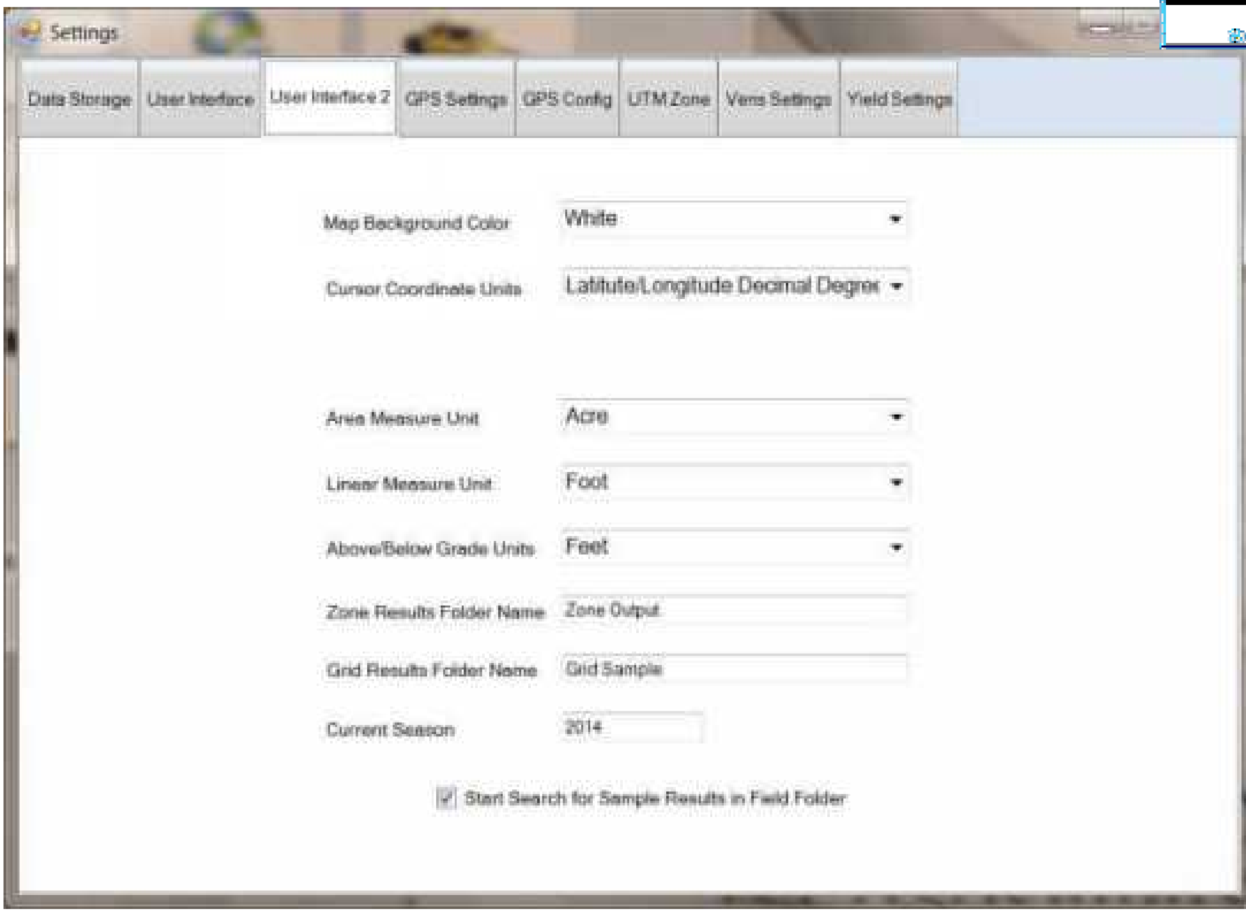
Above are optional settings, not the software defaults.

Default Color Table—color table used for most functions in the software.
Default Color Table (Zones) - color table used only in Auto Zone & Extract Image to Zone
Default Units for New Layers—Units that will be used as default in creating "GRD" files
Process PFR_LOG Files as—Method by which "App Log" GPS data is collected
Default Point Style—Is the shape of "Data Points" (circle / square / triangle/cross-hair)
Default Point Scale Mode—the explanation below will using "5" as the value
Pixel Scale—zooming in and out on a data point it would always be 5 "PIXELS" wide
World Scale—data points would be "5" "Feet" wide
Zoom in = points getting larger
Zoom out = points getting smaller
Boundary Effect Filter Distance—how many "METERS" in the "Boundary Effect Filter reaches. Only applies to use in Auto Zone & Extract Image to Zone tools
Print Map to Bitmap Multiplier—1 = 1to1 ratio to the pixels on the PC display screen. 2 will double the resolution making the files 4 times larger.
Default Pixel Point Size—set the points to "Pixel" size attached to Default Point Scale Mode
Default World Point Size— set the points to "Foot" size attached to Default Point Scale Mode
Default Image Resolution (Meters) - Resolution of surfaces created using Auto Zone & Extract Image to Zone tools.
Minimum Profile Depth (Feet) - Depth of the Yellow to Green line in "Drainage Window"
Maximum Profile Depth (Feet) - Depth of the Green to Orange line in the "Drainage Window"

Settings Window



User Interface 2



Above are optional settings, not the software defaults.

Map Background Color—Able to switch map background color to Black or White. Suggest using white for mapping, the black is useful for GPS—in field use.

Cursor Coordinate Units—changes the values at the bottom of the screen as you move the "mouse cursor" around the screen. (has no effect on the maps or projections)

Area Measure Unit—changes the method by which the area of the surface and area of polygon drawings are calculated.

Linear Measure Unit—changes the method of measuring distance. This will effect the measure tools and how lines in drawing layers are calculated.

Above/Below Grade Units—changes the units in the "Drainage Window" "Profile" area only, giving you option of seeing your cut in "Feet" or "Inches".

Zone Results Folder Name—is the "folder name" created when writing / creating new maps in the "Merge Zone Results" window

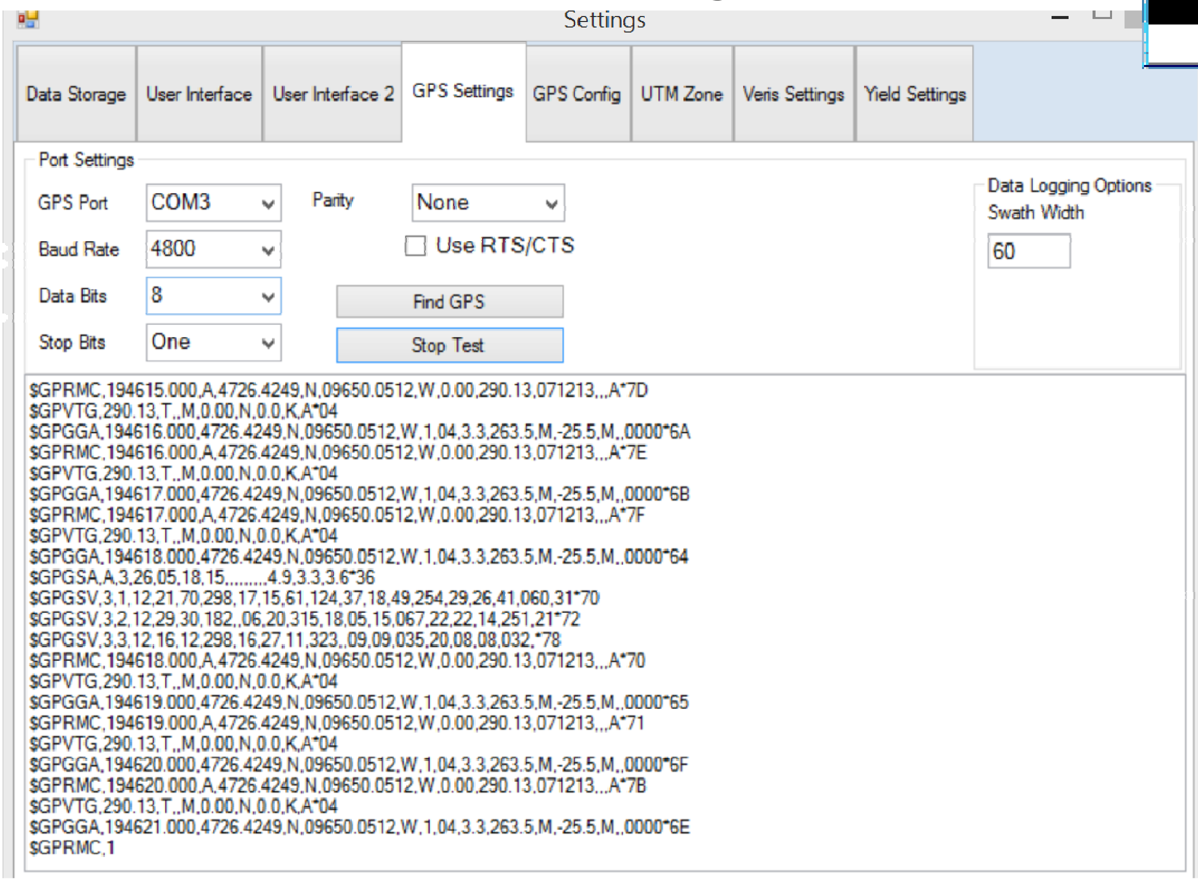
Grid Results Folder Name—is the "folder name" created when writing / creating new maps in the "Merge Grid Results" window

Current Season—adds the "year" to the folder name in "Merge Grid Results" & "Merge Zone Results" windows when writing / creating new maps.

Start Search for Sample Results in Field Folder—Check=start in "Field" folder you are working No check = Start search in last folder

Settings Window

GPS Settings



GPS Port— This is the "COM" (serial communication port) the GPS is connected to. To find out what COM port your device is connect, use the "Find GPS" button or open "Device Manager" and look under "Ports (COM & LPT)"

Baud Rate— Set this value to match the GPS receiver output rate

Data Bits— always set to 8

Stop Bits— always set to One

Parity— always set to None

Use RTS/CTS—(Request to Send / Clear to Send) function required by some GPS units and can be useful in trouble shooting other serial communications problems.

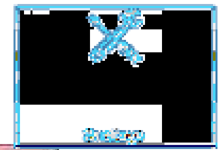
Find GPS Button— Searches through all the COM ports & all the BAUD rates looking for a valid GPS signal. Function may not work if you are indoors and have no GPS signal.

View GPS Data Button— Shows GPS data strings in the window below to confirm you have signal.

ADMS GPS REQUIRES— the source GPS to supply the following data strings

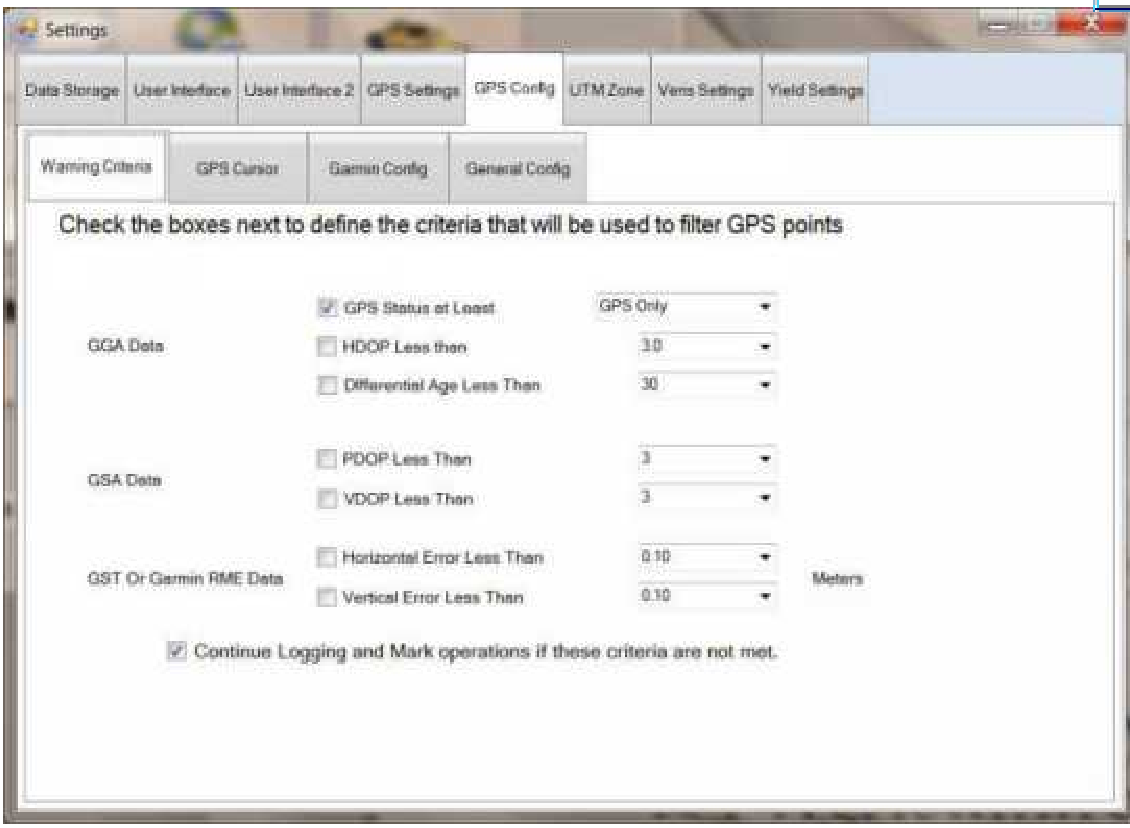
- GGA
- GSA
- RMC *(or VTG can be used in its place)*
- *GST (this data string is OPTIONAL)*

Settings Window



GPS Config

Warning Criteria



Above are suggested setting for "Soil Sampling" only (not collecting field boundaries or topo data)

If these Criteria are not met the GPS status bar will flash "RED" and you will hear a "Ding"

GPS Status at Least—logs data that has a GPS Signal of at least this or greater (ex-GPS Only)

HDOP Less Than— only logs data that has a value less than this number (ex-3.0)

Differential Age Less Than— logs data that has a value less than this number (ex-30)

PDOP Less Than— logs data that has a value less than this number (ex-3)

VDOP Less Than— logs data that has a value less than this number (ex-3)

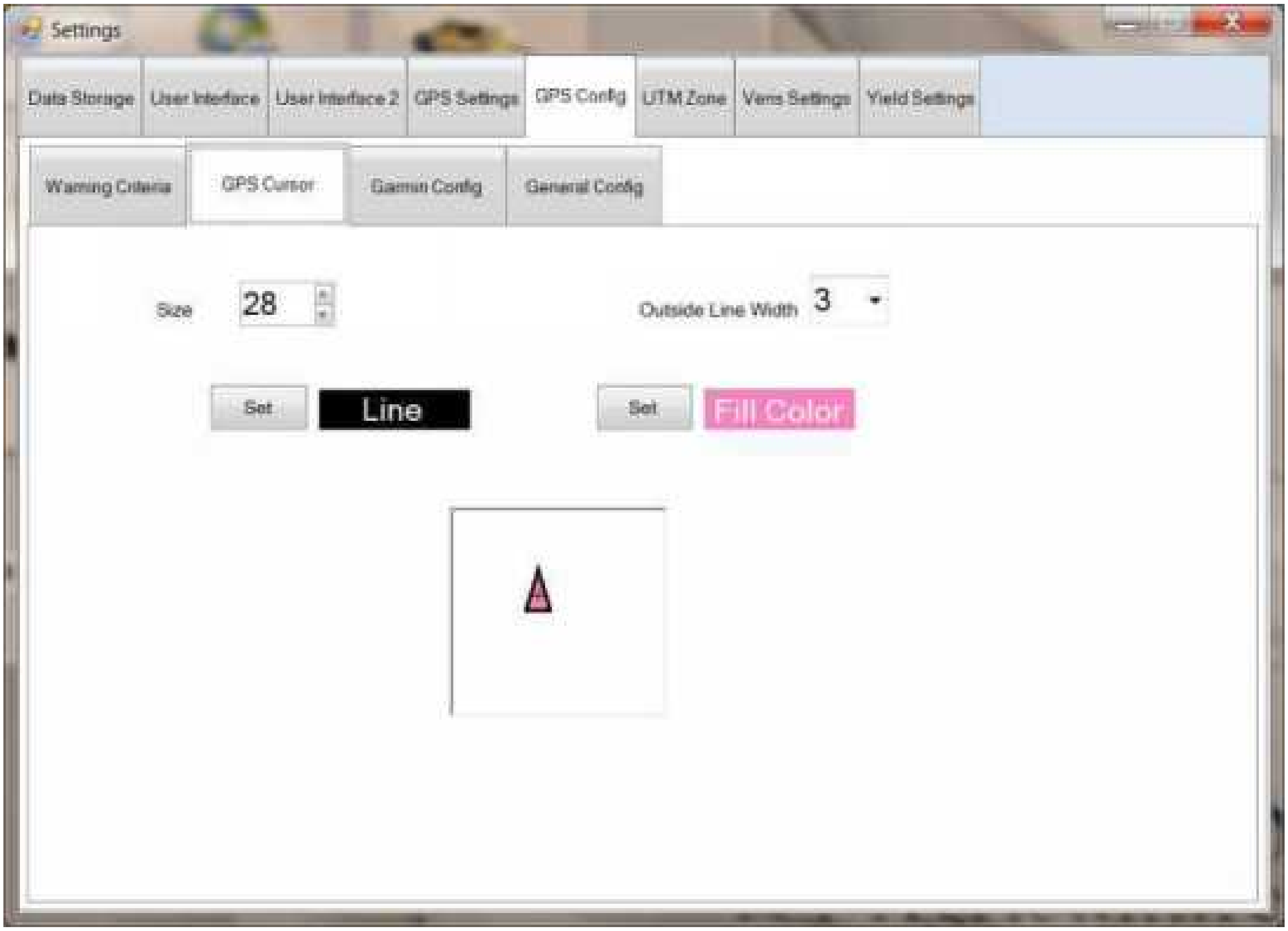
Horizontal Error Less Than— logs data that has a value less than this number (ex-0.10 meters)

Vertical Error Less Than— logs data that has a value less than this number (ex-0.10 meters)

Continue Logging and Mark Operations if these criteria are not met.
Checked will allow you to continue logging if there is any valid GPS signal.
Not checked the software will stop ALL logging & application functions.

Settings Window

<u>GPS Config</u>
GPS Cursor



Above are optional setting, not software defaults.

Size—is in the number of "Pixels" not feet. (size preference is relative to your Screen Resolution)

Outside Line Width—is in number of "Pixels" wide

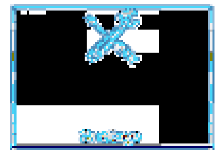
Line Color— set to your color preference. (think about background map colors-contrast is good)

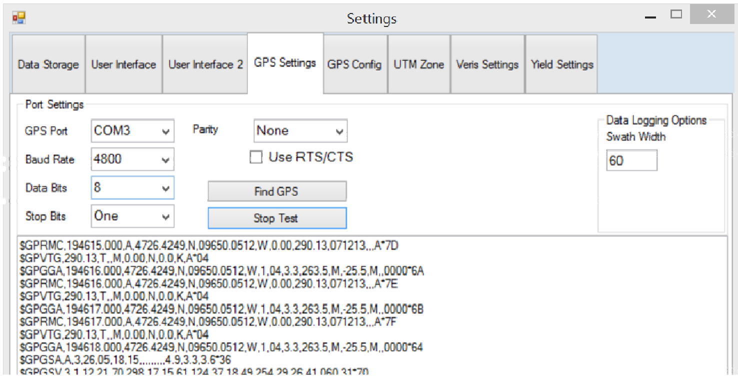
Fill Color— set to your color preference. (think about background map colors-contrast is good)

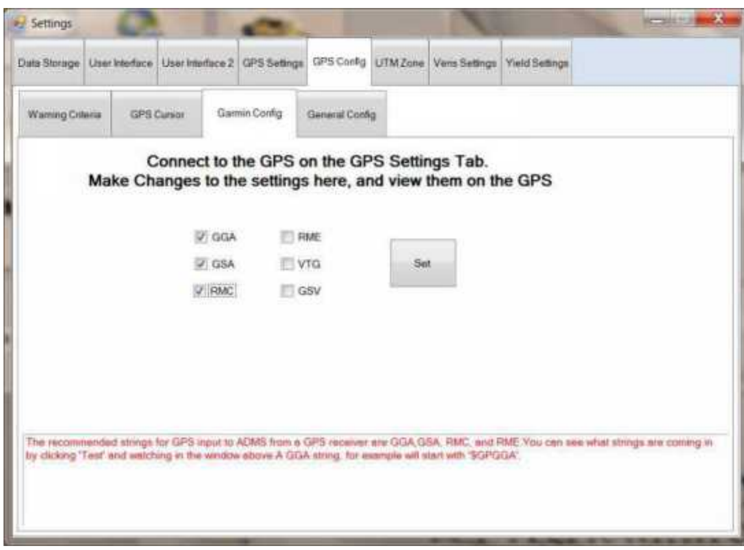
For these settings to take affect. The "Map Window" or "Log & Sample" window must be closed and re-opened if you are trying to adjust these settings with these windows open.

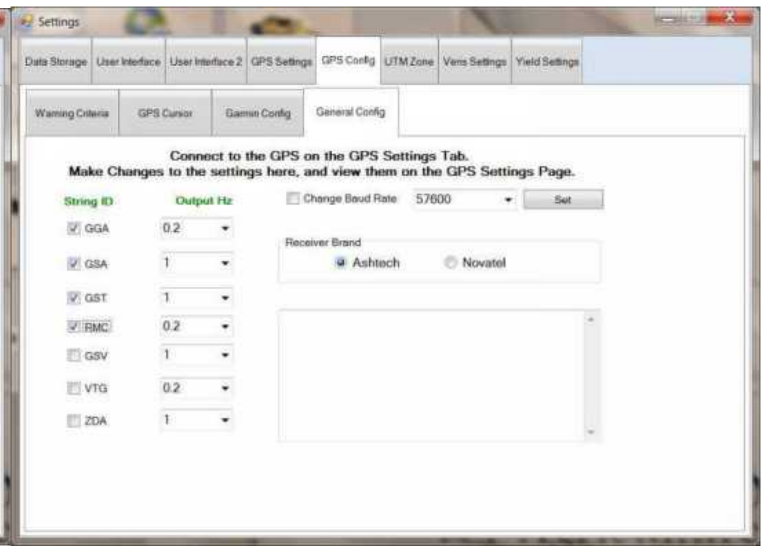
Settings Window

GPS Config









Above settings are recommended if working with one of these three GPS receivers.

To use these options you must have the "GSP Settings" tab in the "View GPS Data" mode. This means that data is "STREAMING" across the viewing area of the screen. Then go to the "GPS Config" tab either the General or Garmin setting.

Check on the data strings you want the device to put out.

Set the Hz rate (Data strings per second)

2 = 1 data string every 2 seconds or 1 string every 2 seconds
1 = 1 data string every 1 second or 1 string per 1 second
0.2 = 1 data string every 0.2 seconds or 5 strings per 1 second

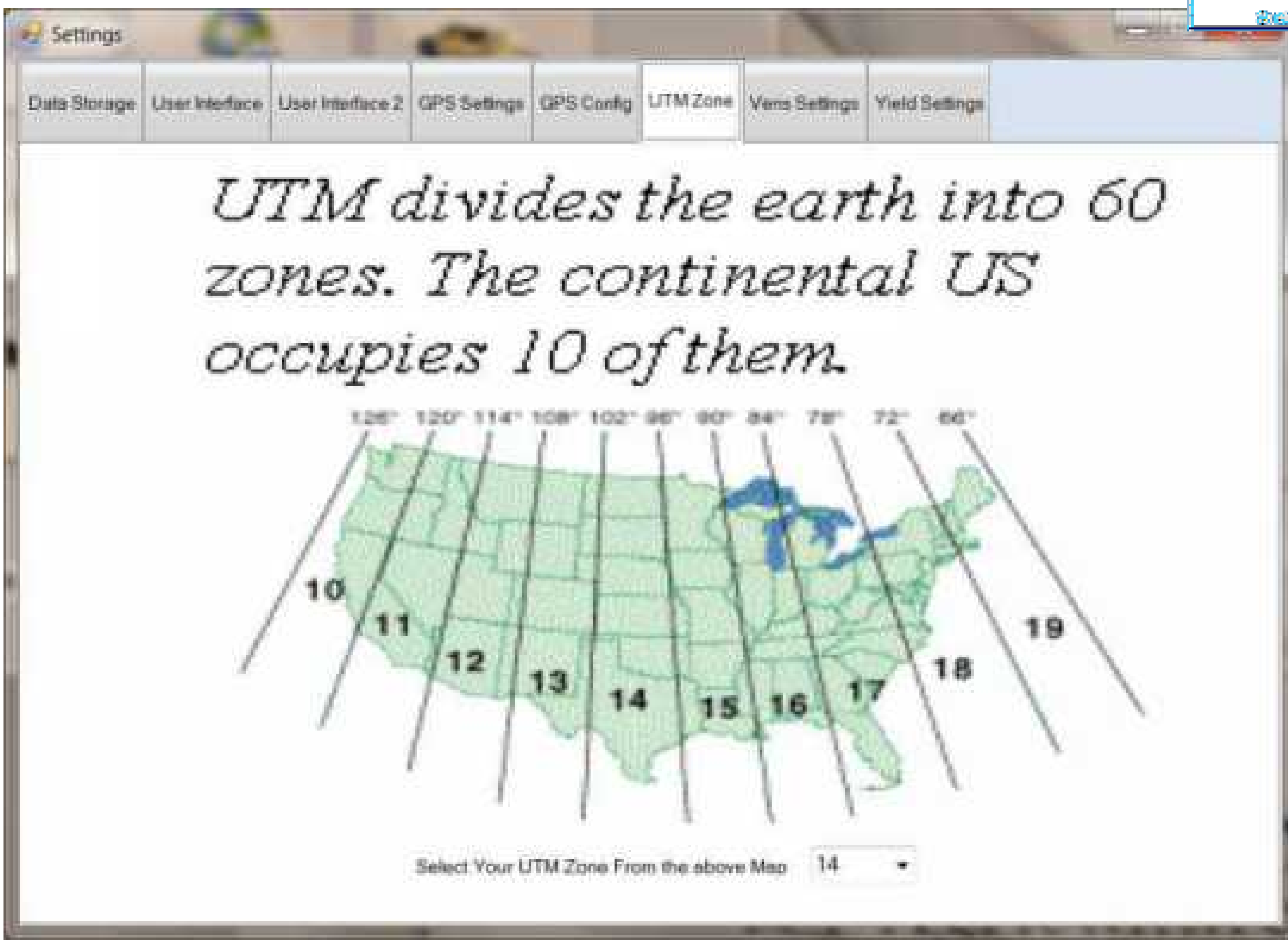
If you want to change the baud rate check the box and adjust the rate.

Click the "Set" button

If this does not work you may have to check the "Use RTS/CTS" button in the "GPS Settings"

Settings Window

UTM Zone



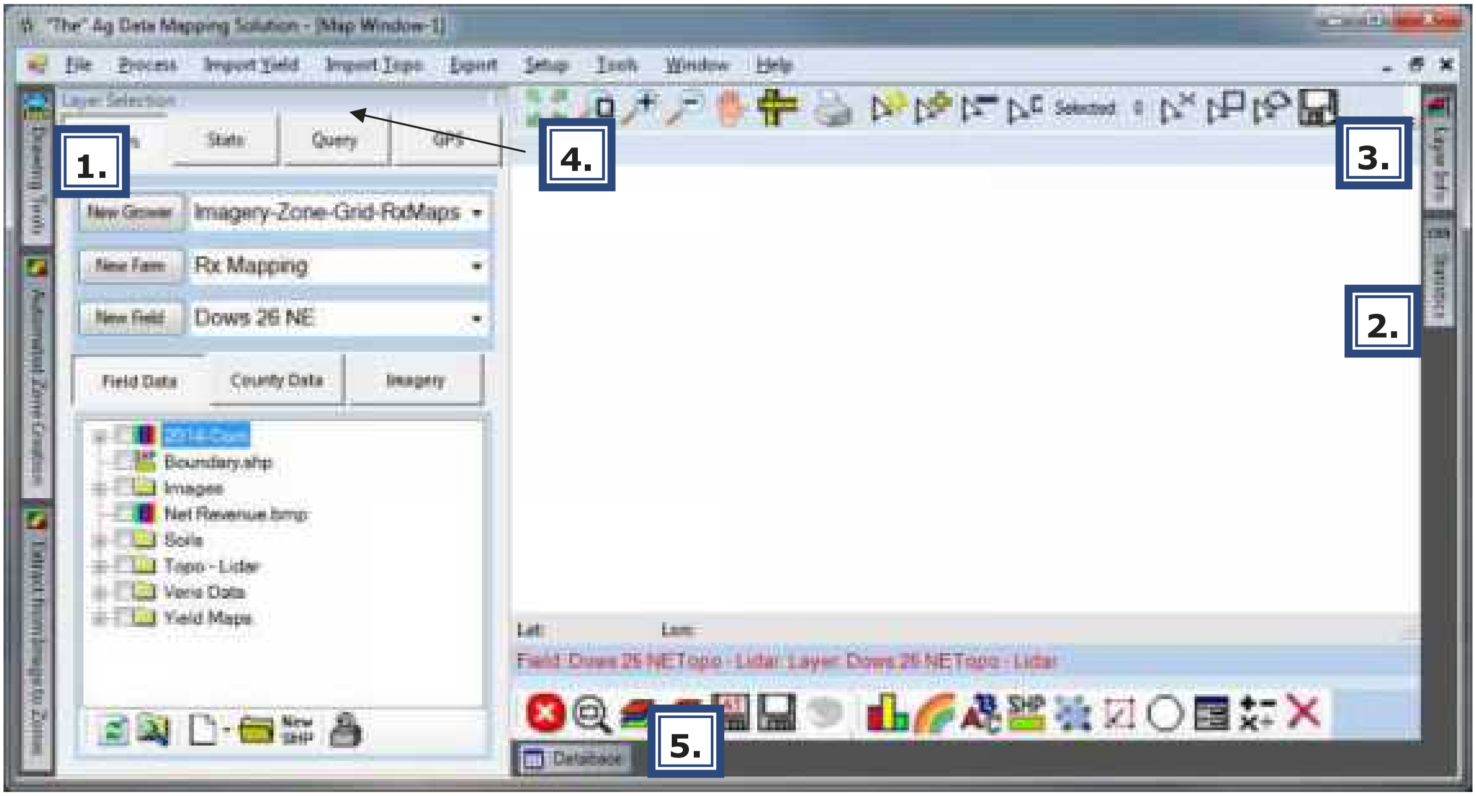
Choose the correct zone for where you are working. One of the major drivers for what UTM you use is the FSA—NAIP imagery. We suggest setting your UTM to match what the Government has assigned for the Imagery. If you are in an area where there is no NAIP imagery, use the UTM zone of the Landsat data that best fits your area. Questions here please contact your support staff at GK Technology Inc.

UTM—Acronym for "Universal Transverse Mercator". A projected coordinate system that divides the world into 60 north and south zones, 6 degrees wide. This is what everything is projected in within the software. Being in the correct UTM zone is critical to ensure the location is accurate.

Other Notes on Projection and Units for ADMS.
ADMS supports Vector data (SHP) files in UTM or LAT/LON coordinate systems. All images coming in must be in UTM coordinate system. ALL UTM objects must have the units in METERS (for Northing / Easting).

Window Dock Settings

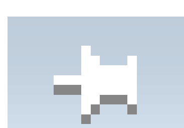
Within ADMS there are many different window configurations. Depending on which unlock you have there may be different panels available to you. At a minimum there will be Drawing Tools (1.), Statistics (2.), Layer Info(3.), Layer Selection (4.), and Database (5.). By default the Layer Selection panel is pinned open when the software first is started.



Drawing Tools— The drawing tools window has tools to merge polygons together to create poly-polygons as interior or exterior polygons.
Statistics—This panel will show layer statistics of the active surface layer.
Layer Info—This breaks apart the layers that are loaded into the software in three different categories: Drawings in Map, Surfaces in Map, and Images in Map. In this panel layers can be cleared, made active, and re-ordered.
Layer Selection—This panel has the data tree in it along with the query tool and GPS.
Database—The database gives the user access to the database in a SHP file, or a attribute table in a CSV. Data can be queried, sorted, added, deleted, and have math operations performed on it.

Docking the Windows

Each of these windows will have a thumbtack icon in the top right corner. If the thumbtack is clicked on the window will be permanently docked open. This can be useful for certain types of data processing and allow for easier access to some of the toolbars. Once pinned open the map window and toolbars will automatically resize.

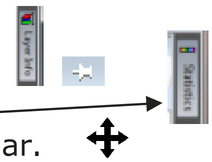

Unpinned


Pinned

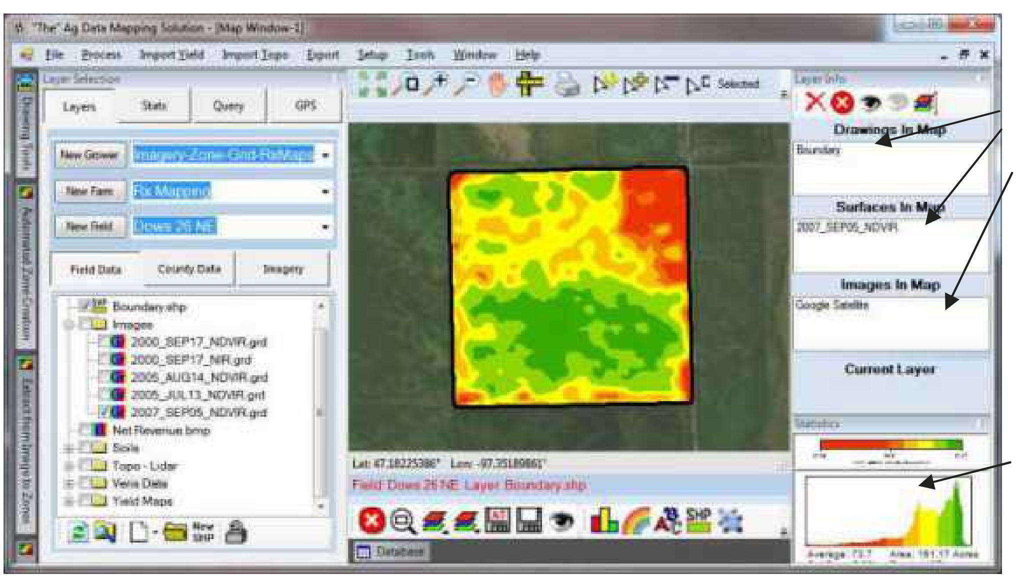
Window Dock Settings

These panels can also be docked inside each other or moved to a different location. This gives the software users may options to fit their preferences.

To dock or move a panel first open and pin everything you want open permanently. Next click on the panel you wish to move. For this example the statistics window will be used and get docked under the Layer Info Panel. This allows the user to see all the layers that are loaded and allow for easy visibility to layer statistics.



- Click on Layer Info to open it followed by the thumbtack to dock it open.
- Click on the Statistics to open the window over top of the Layer Info.
- Left click on the window header to make a four way crosshair cursor appear.
- Hold and drag the window out of the side to where you want it. In this example will want to dock it under the Layer Info so drag it to the bottom of layer info. Once there it will show a preview of it snapping in place.
- Once you see it snapping in place let go of the cursor. It will then be docked in place.



After docking now all the layers are visible that are currently turned on within ADMS.

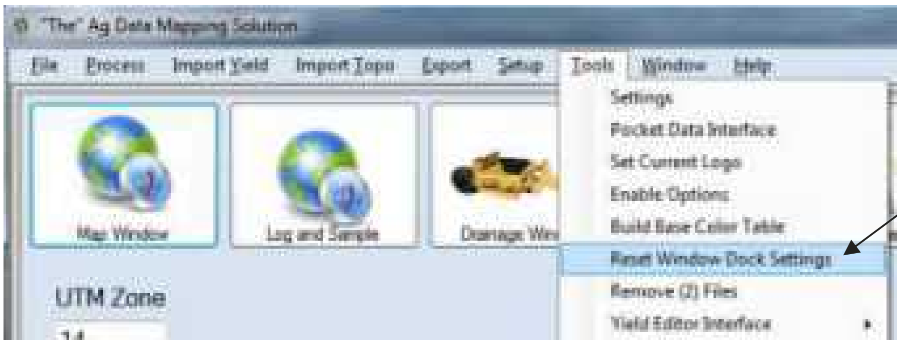
The histogram is easily visible for the surface layer turned on in the map window.

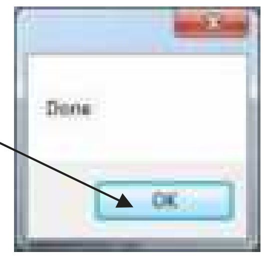
Window Dock Settings

Resetting Window Dock Settings

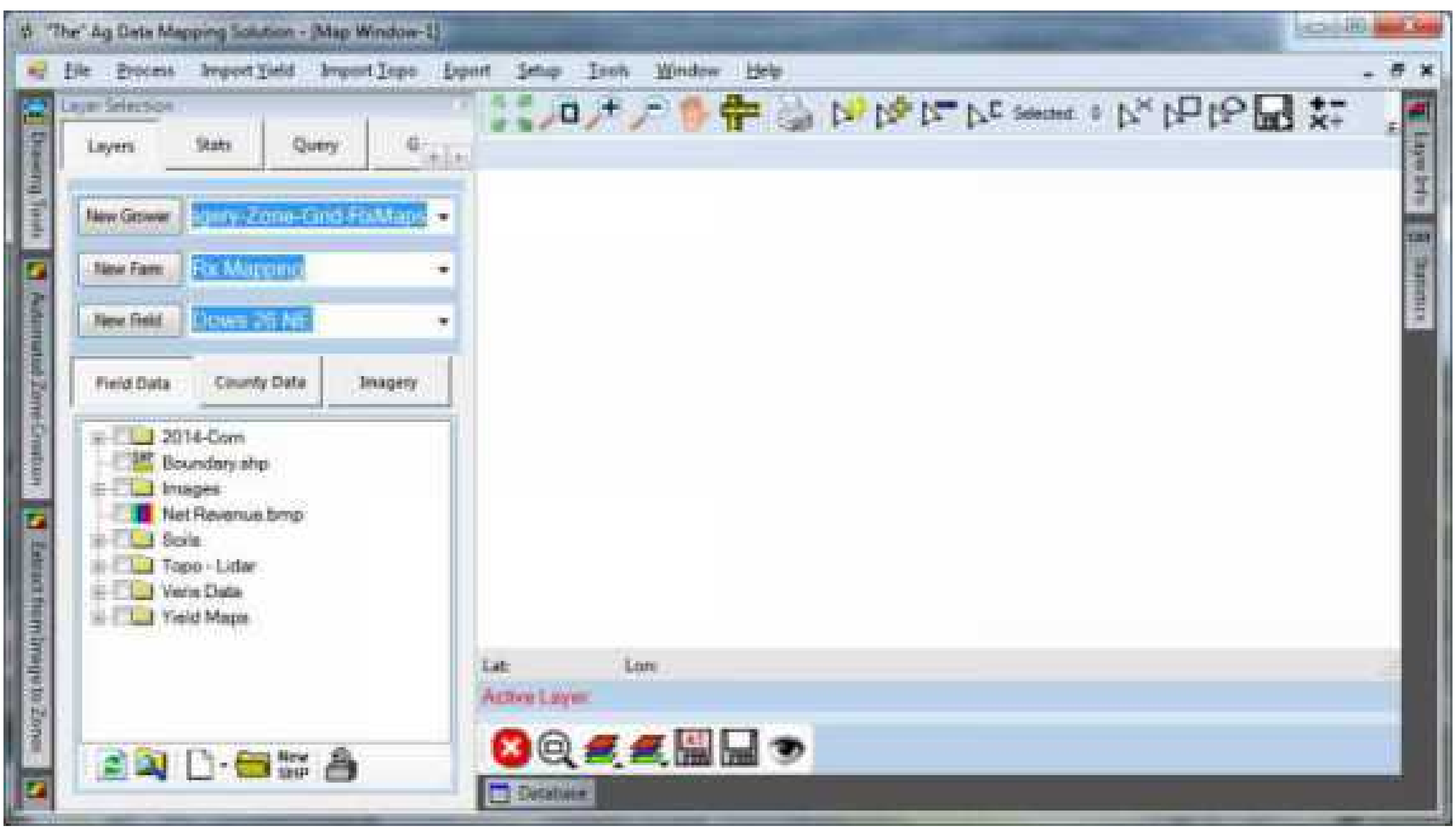
Sometimes when working with different windows one will "disappear." What actually happens is a panel will get moved behind the main window and it can't be accessed. Also, if the windows are in a configuration that you aren't happy with they can be reset.

- CLOSE THE MAP WINDOW—This is a very important step. If the map window is open the settings will not work.
- Go to the to toolbar above the startup window select Tools ► Reset Window Dock Settings



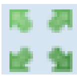


- Click Reset Window Dock Settings
- A window will appear that says "Done."
- Open the Map Window. All the panels will be docked the same way they were when the software was first installed.



Top Map Toolbar

Map Window Toolbar



Zoom to Project Extents - Zooms out to the full extent of all the layers that are open.

Zoom to Rectangle - Zooms to the user drawn rectangle on the map.

Zoom In – Re-centers the image to wherever you "Left Click" and zooms in on that area ("Right Click" to turn off tool).

Zoom Out – Re-centers the image to wherever you "Left Click" and zooms out on that area ("Right Click" to turn off tool).

Move - "Left Click", hold down and drag on the map - when you release the "Left Mouse Button", your image will move ("Right Click" to turn off tool).

Tape Measure - Allows you to find distances and heading by left clicking around your screen.

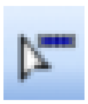
Print - Takes you directly to the "Print Map" function.

Top Map Toolbar

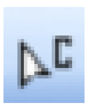
Map Window Toolbar

Select Mode: Replace - Sets the mode of selection to add a single object for all the select tools, allowing selection of a single item (of Active-”Drawing Layer”).

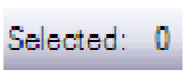
Select Mode: Add - Sets the mode of selection to add multiple objects for all the select tools, allowing you to add multiple selections (of Active-”Drawing Layer”).



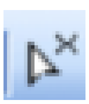
Select Mode: Subtract - Sets the mode of selection to remove multiple objects for all the select tools, allowing removal of multiple selections (of Active-”Drawing Layer”).



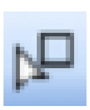
Clear Selection - Clears all the selected items (of Active-”Drawing Layer”)



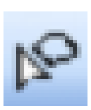
Selected Objects - Shows you how many objects you have “Selected” in your Drawing Layer.



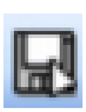
Select With Click - Allows selection of a single item in the active layer, must choose the "Select With Click" button for every object (of Active-”Drawing Layer”)..



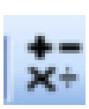
Select By Rectangle - Allows selection of multiple Points, Lines and Polygons by drawing a “Rectangle” around them or intersecting with object (of Active-”Drawing Layer”)..



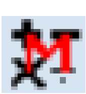
Select By Polygon - Allows selection of multiple Points, Lines and Polygons by drawing a “Polygon” around them or intersecting with object (of Active-”Drawing Layer”)..



Save Selected Objects to New Layer - Once you have selected your Points, Lines and Polygons from a layer, you can "Save" these items to a newly named layer.



Multi Layer Map Math - Opens a new page in which you can write scripts to perform different functions and apply algorithms on your selected layers.

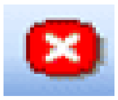


Multiple Output Map Math - Consultants only option. Opens a new page in which you can write scripts to perform different functions and apply algorithms on you selected layers. This function will allow you to create “Multiple Output maps” in one click from a script.

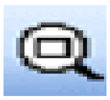
Quick Math - Consultants only option. Allows scripts to be quickly run from a dropdown menu that have previously been saved as a DLL.

Bottom Layer Toolbar

Bottom Toolbar—Basic Buttons



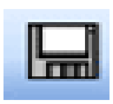
Remove Layer - Removes the selected layer from the map (does not DELETE layer). The layer can be turned on again later.



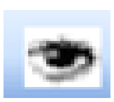
Zoom To Layer - Zooms to the extent of the selected layer.

Bring to Front - Moves the selected layer to the front of (or on top) all layers.

Send to Back - Moves the selected layer to the back of (or bottom) all layers.



Save Changes - Quickly saves any changes made to the selected layer.



Layer Visibility On/Off - Turns the visibility of the layer on and off.

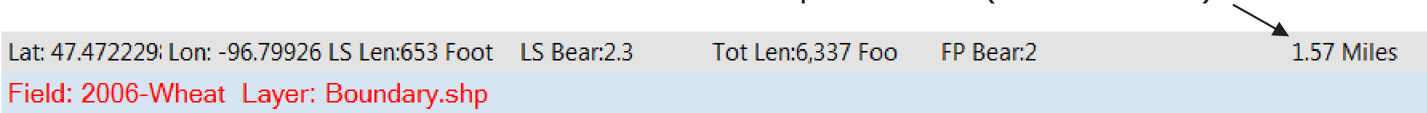
Address Bar and Active Layer

Cursor Coordinates—Values will be in either Latitude / Longitude **or** UTM—Northing / Easting of the "Cursor" location (adjusted in the settings)

These values only show when drawing a LINE or POLYGON

- **LSLeng:** Line Segment Length = distance from your last click to cursor.
- **LS Bear:** Line Segment Bearing = degrees for your last click to the cursor
- **Total Len:** Total Length = length of line or polygon drawn from first click to cursor
- **FP Bear:** is First Point Bearing in Degrees

Value on the RIGHT is the distance across the "Map Window" (East to West)

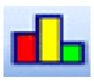


The data in RED—is the **ACTIVE LAYER — VERY IMORTANT !!!!!**

This line tells you what layer you are actively working on and what layer the buttons will affect or change.

Bottom Layer Toolbar

Drawings Buttons

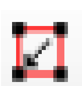
 **Change Draw Style** - Changes the line and point attributes (color, sizes and fill).

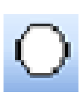
 **Thematic Draw Settings** - Opens a new window which allows the user to change color themes, adjust the number of color ranges, view statistics of the color ranges, and fill and size the points and lines.

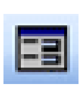
 **Change Label Settings** - Allows the user to view data from the objects data table in the viewing window as a label. Also allows label size, font, and color adjustment.

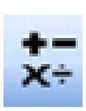
 or  or  **Draw New Object** - Once selected, you may draw a polygon, line or point (left clicking to draw and right clicking to end lines and polygons.

 **Decompose a selected PolyPolygon to its Component Polygons** - To use this button "select" a PolyPolygon then click the button. Suggest doing a "Save As" and rename the drawing layer. This will save the Polygon in it's component state.

 **Move Vertices of Selected Object** - Is a TOGGLE on/off button that allows you to move the Vertices of Polygons and Lines. Object must be "selected" before using this button.

 **Draw a Circle** - Once selected, left click and hold down in the center of the object and drag to the desired diameter and release to create a circle polygon.

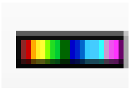
 **Drawing Properties** - Double clicking on an object, opens the properties of that item.

 **Intra-Layer Math** - Allows use of simple mathematical functions on a column of the data base.

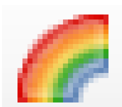
 **Delete Selected Objects** - Once an object of this layer is selected, this will delete the selected objects. Changes must be saved to be made permanent.

Bottom Layer Toolbar

Surfaces Toolbar

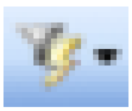


Change Color Theme - Changes the color pallet used on the selected layer.



Thematic Color - Opens a window to view image statistics, adjust color themes, number of zones, and adjust zone sizes automatically or manually.

Load Fixed Thematic Table - Applies a color theme that has been previously created to active layer.

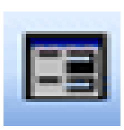


Smoothing Filter - Combines pixels of the image creating a smoother image.

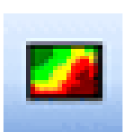
Fill Filter - Fills null values in and around the image by stretching or copying the value of the nearest pixel.

Apply mod to Selected Polygon - Allows use of simple mathematical functions on selected layers using a combination of Polygons with Raster.

Trim End Values - Allows the change or deletion of values above, or below, a given value (making all the removed values equal to the trim value). Deleted values create a hole that will need to be filled.



Surface Properties - Tools to change "Units" and adjust the Geo Reference and Resolution of the Surface.

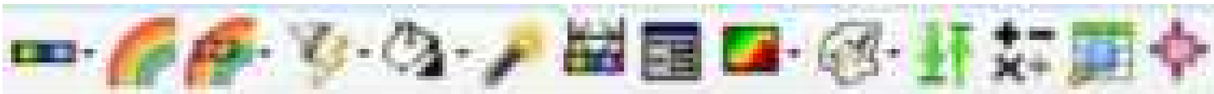


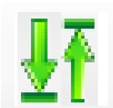
Crop Raster to Selected Polygon - To use this tool, FIRST SELECT A POLYGON. Once the polygon is selected and you have reselected the surface layer you want to cut to, this button will remove all the image outside of the selected polygon. ("Just this Layer" Don't forget to SAVE or SAVE AS!) ("All Visible" cuts all loaded surfaces and AUTO SAVES — BE CAREFUL)

Reduce Boundary Effect - Will go around the field boundary looking in X—Meters and stretch that value over the selected distance.

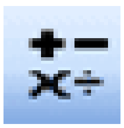
Bottom Layer Toolbar

Surfaces Toolbar

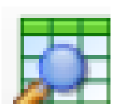




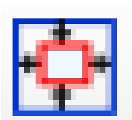
Invert - Inverts the Pixel "Values"



Intra-Layer Math - Allows use of simple mathematical functions on the active layer.

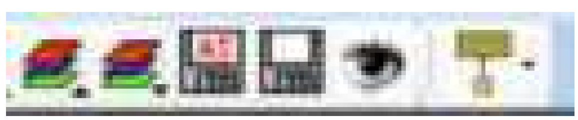


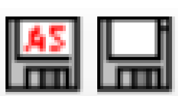
Correlation Matrix - Runs Correlation analysis on all loaded surfaces.



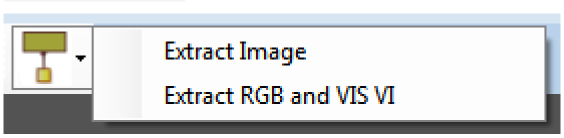
Crop Null Values - After cropping some raster's you may have "Blank Pixels" left in the Surface. Crop Null Values will remove these "Blank Pixels" and "Save" the object.

Web Layers Toolbar





Save/Save As - When working with web layers both buttons do the same thing. They allow the layer to be saved back to "Field Data."



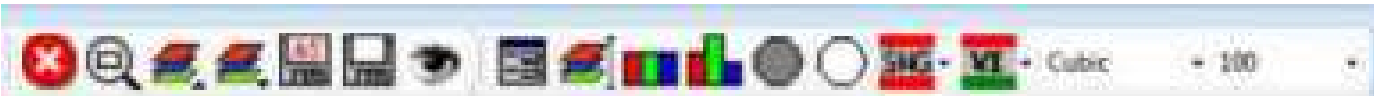
Extract Layer - This button gives two options.

1. Extract the RGB image and save it back to "Field Data."
2. Extract the RBG image as TIF file and extract the VIS VI as a GRD surface. Both of these layers will be saved back to "Field Data."

Choose Cell Size - This option appears after the above save options are used. Different resolutions can be chosen for the final image/extracted surface.

Bottom Layer Toolbar

Multi-Band Image Buttons (TIF & BMP)



Multi-Band Image (SID & JP2)

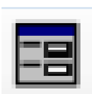
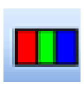
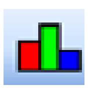
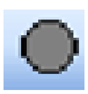


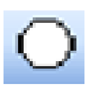
Image Properties - Allows the geo-referencing of an image to be adjusted.


Multi-Band Layer Display - Select which bands of light and what order they are displayed.

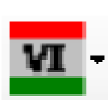

Equalize Image Display - Lighten or equalize the bands of light being displayed.


Reset Color Adjustment - Move the color bands back to their original settings.

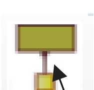

Darken - Adjusts the brightness of the displayed image darker.

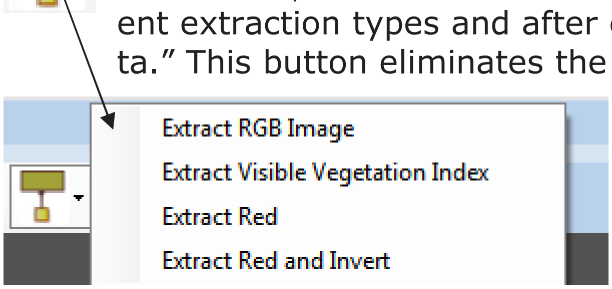

Brighten - Adjusts the brightness of the displayed image brighter.

Single Band Extraction - Lets individual bands be extracted from an image. These are the bands that are adjusted in the "Multi-Band Layer Display"



Visual Index - Applies different vegetative indices depending on the type of image and bands available. For RGB images the option will be "RGB VI" (Red, Green, Blue Vegetative Index). If the image is CIR or has an inferred band there will be a RNDVI and GNDVI option.

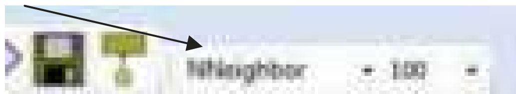

Extract From SID/JP2 – *This is a consultants package only option. To use this button, must SELECT a boundary first. This button will give a list of different extraction types and after extraction they will be saved back to "Field Data." This button eliminates the need to extract a TIF from SID/JP2 first.



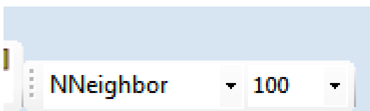
Bottom Layer Toolbar

Images - Re-Sample Display Modes

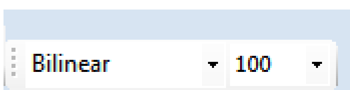
Both images and surfaces can have their appearance adjusted by changing the re-sample modes on the bottom toolbar. This affects only how the data is displayed and does not affect processing.



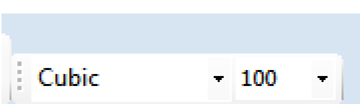
NNeighbor—Selects the value of the nearest point and does not consider the value of neighboring cells



Bilinear—Linear interpolation is done in one direction and then again in another direction

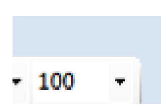


Cubic—Takes 16 pixels into account and generally has a smoother appearance than Bilinear or NNeighbor interpolation



Transparency Settings

Both Images and surfaces can have their transparency adjusted for visual purposes. The number is in a Percentage (%).



**Note: Windows 7 there are issues with the transparency settings for surfaces. Therefore, if layering with an image the image should be brought to the front and it's transparency should be adjusted.*

Drawing Layers (Polygons, Lines, & Points)

In Ag Data Mapping Solution, there are 4 ways to create/add Drawing Layer Data. Drawing Layer Data can consist of Boundaries, A-B Lines, Tile Lines, Sample Points, Sample Grids, As Applied Maps, some Application Maps & many more files. *All the below examples are using the "Map Window". Some other windows may not have the same functionality.*

1. **Import from Another Source**
2. **Extract Drawing Layers from a Mass Collection**
   (FSA-CLU Field Boundaries/Roads/Yield Data)
3. **GK Drawing Tools-Hand Drawing**
4. **Collect with GPS Using Ag Data Mapping Solution**

- Importing from Another Source

Polygons (boundaries), lines and points that have been collected using another source such as a tractor, pickup, ATV or hand drawn (in other software), all of these would be coming from a different software package. If these files are coming from another software package, export the files out as Shapefiles (.shp) and save them into the appropriate Grower / Farm / Field (C:/GKData/xxx/xxx/xxx). If you are copying these Shapefiles, make sure you get all the extensions of the shape file (Min requirement .shp, .shx & .dbf). Paste them in to the appropriate Grower / Farm / Field (C:/GKData/xxx/xxx/xxx). ADMS does handle "Imports" from certain sources. Generally, you need to have the original data cards from the equipment. Find out by clicking on the "Import" tab while using "Map Window".

Drawing Layers (Polygons, Lines, & Points)

Extracting Drawing Layers from a Mass Collection

(FSA - CLU Field Boundaries/Roads/Yield Data)

To use this function you must "SELECT" the Drawing object you want to "SAVE" or "CREATE"

There are three ways of selecting these objects. To use them you must first turn on the drawing layer that contains the objects to be saved (CLU-Yield Data-Roads-Topo Data). Key to this process is watching your "**ACTIVE LAYER on the Bottom Toolbar**"

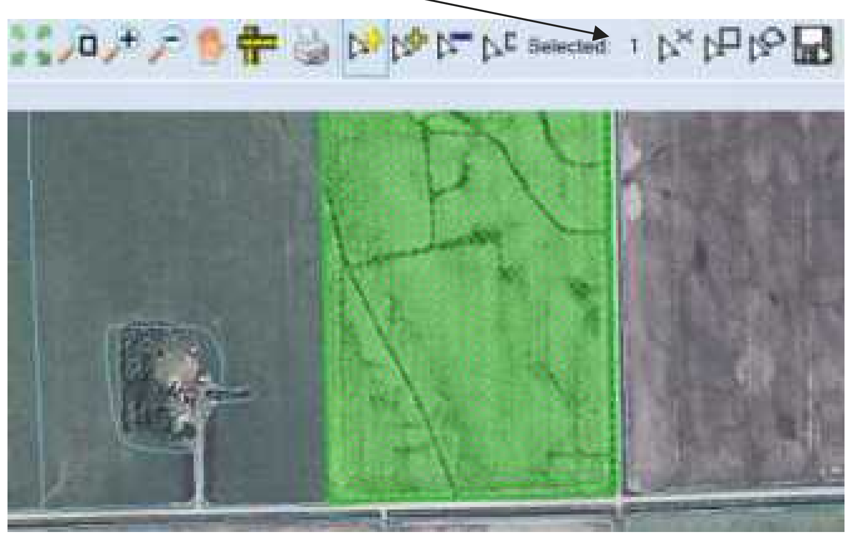
1. **Select by Click**—Simply left clicking on or in the object
2. **Selecting by Area—**Basically drawing a boundary around the object.
3. **Selecting by Database**—Using the "Database" tab and choosing the object out of the dataset. Database

The next examples will explain these functions.

-Selecting by Click—(Example with "POLYGONS")

1. For this example, turn on FSA (CLU) field boundaries (Multiple SHP file Object).
2. Select **"Select Mode Replace"** & **"Select with Click"** on the top toolbar.

   ** Note: This is selected by default when software starts **
3. "Left Click" inside the Polygon (Boundary) you want. *By holding down the "Ctrl" key you can select multiple objects*.
4. Note that the Polygons have turned "Lime Green" showing they have been selected.
5. Top toolbar -note number of "Selected:" objects
6. On the TOP TOOLBAR, select **"Save Selected Objects to a New Layer".**
7. This will open into a "Save" window.
8. Notice it is saving back into your "Field" level data every time.
9. Name the object & click **"Save"**.



Drawing Layers (Polygons, Lines, & Points)

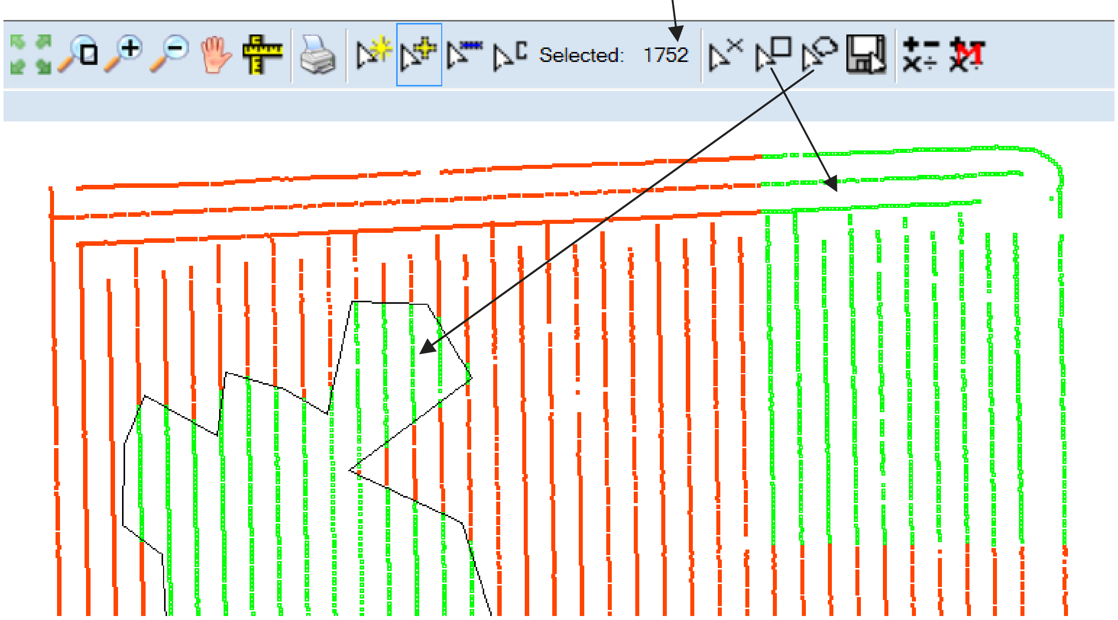
Extracting Drawing Layers from a Mass Collection

(FSA - CLU Field Boundaries/Roads/Yield Data)

Selecting by Area—Example with "POINTS")

1. For this example, turn on Yield Data, Veris Data or Topo Data as "Points" Shape file.
2. Select the **"Select Mode Add"** off the top toolbar. 
3. Then select either **"Select by Rectangle"** or **"Select by Polygon"**
4. Then follow the directions below the top Toolbar.
5. Note that the objects have turned "Lime Green" showing they have been selected.
6. Top toolbar -note the number of "Selected:" objects.
7. On the TOP TOOLBAR, select **"Save Selected Objects to a New Layer".** 
8. This will open into a "Save" window.
9. Notice it is saving back into the "Field" level data every time.
10. Name the object ***(you MUST Re-Name the object)*** & click **"Save".**

Selected by "POLYGON" **Selected by "RECTANGLE"**



Drawing Layers (Polygons, Lines, & Points)

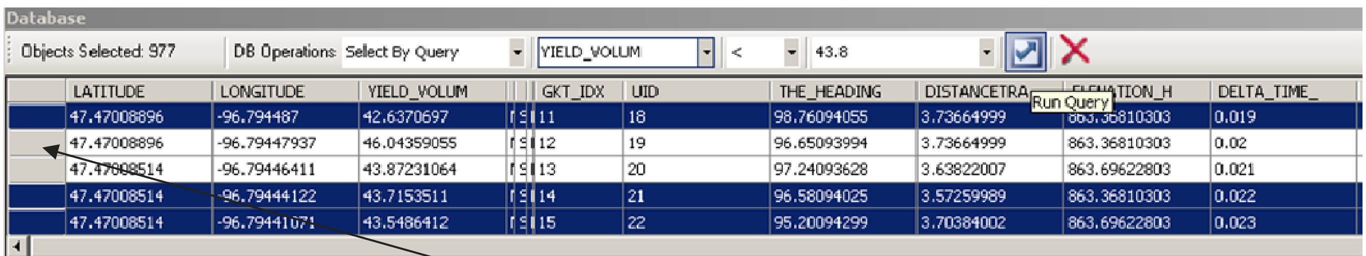
Extracting Drawing Layers from a Mass Collection

(FSA - CLU Field Boundaries/Roads/Yield Data)

Selecting by Database—(Example with "POINTS")

1. For this example, turn on the yield data points.
2. On the bottom left corner of the screen, click on **"Database"** tab. 

3. This will open the database of the "Active Drawing Layer" or the last active SHP.



LATITUDE	LONGITUDE	YIELD_VOLUM	GKT_IDX	UID	THE_HEADING	DISTANCETRA	ELEVATION_H	DELTA_TIME_
47.47008896	-96.794487	42.6370697	11	18	98.76094055	3.73664999	863.36810303	0.019
47.47008896	-96.79447937	46.04359055	12	19	96.65093994	3.73664999	863.36810303	0.02
47.47008514	-96.79446411	43.87231064	13	20	97.24093628	3.63822007	863.69622803	0.021
47.47008514	-96.79444122	43.7153511	14	21	96.58094025	3.57259989	863.36810303	0.022
47.47008514	-96.79441071	43.5486412	15	22	95.20094299	3.70384002	863.69622803	0.023

4. Selection Methods :

   A. By "Left Clicking" on the gray cell on the left side of the table. (Note the Database Row highlights and the Map Object turned "Lime Green" showing they have been selected).

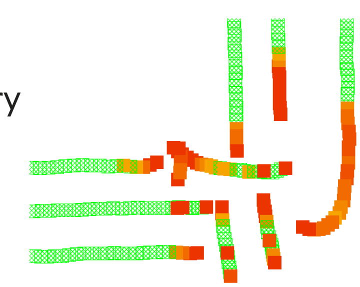
   B. By holding down the "Shift" key and left clicking a row further down in the database, you can select groups of objects.

   C. By holding down the "Ctrl" key and left clicking a row and another row, you can select multiple individual objects throughout the database.

   D. Using the DB Operations : "Select by Query", you can select a "Column" and Query out objects (>,<,=,>=,<= (on numeric columns)) and (=,<> (on character columns)), put in your values and click **"Run Query"**. 

   *NOTE: The "**Object Selected:"** in the upper left hand corner of the Database window, this will tell you how many objects are selected in the Database.*

5. On the TOP TOOLBAR, select **"Save Selected Objects to a New Layer"**. 
6. This will open into a "Save" window.
7. Notice it is saving back into the "Field" level data every time.
8. Name the object ***(you MUST Re-Name the object)*** & click **"Save"**.



Drawing Layers (Polygons, Lines, & Points)

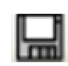
GK Drawing Tools - Hand Drawing (Polygons)

- Using the hand drawing tools, you will need to have a "Layer" turned on that you can Trace, or Mark, on top of for geo-referencing purposes. (Accurate, high quality data is needed).
- Look at drawing Polygons & Merging Interior / Exterior Polygons (Poly-Polygons)

- Polygons (Drawing—Field Boundaries)

1. Hand Drawn is done using either field collected data points or 1-3 meter aerial-images. Both giving geo-referenced data to trace.
2. Zoom into the field as close enough to see and draw all details.
3. At the bottom of the "Data Tree" Select "Create New Layer From Template".
4. Select "Boundary" from the template list. 

5. In the "Data Tree" check the **"Boundary.shp"**.
   Note: ACTIVE LAYER—Below the Map Window — Field:Name Layer:Boundary.shp
6. On the "Bottom Toolbar" click on the **"Draw New Object"** button . 

7. In the map window area, follow the instructions at the top of the "Map Window"
   Drawing Tool Selected, Left Click each Point, to Define the New Object, Right Click to Finish
   *Note: if you make a mistake while drawing—Hold Down the **"Alt" - Key** and "Left Click" to undo last point.*
8. "Right Click" to finish the Polygon.
9. If there is a second & third boundary (interior or exterior) repeat 6—8.
   The next page will create the "interior—exterior" polygons
10. Once finished drawing the "Boundary", click **"Save"** on the bottom tool bar. 

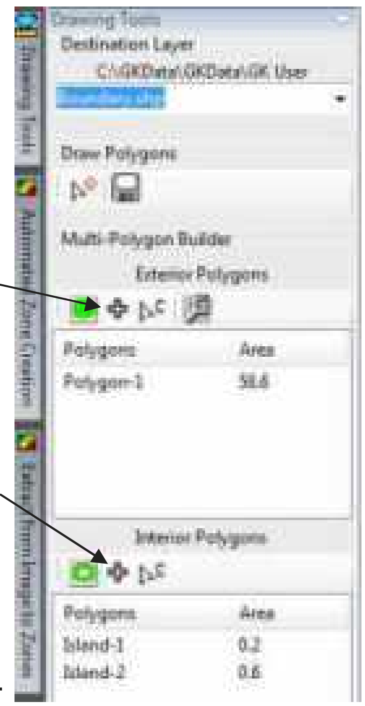
Drawing Layers (Polygons, Lines, & Points)

GK Drawing Tools - Merging Boundaries

Exterior / Interior Polygons (Creating Poly-Polygon)

1. Turn on your Multiple Polygon Boundary.
2. Open the **"Database"** tab (lower left corner). 

3. Click on the row tabs in the "Database" that contain exterior polygons, this will highlight the whole row and the object will highlight "Lime Green" in the map window.
4. Click on the **"Drawing Tools"** tab on the Right side.
5. Click **"Add Selected Polygons"** in the "Exterior Polygons" area. (If incorrect objects selected, click **"Clear Polygon Collections"**).
6. Click on the row tabs in the "Database" that contain interior polygons, this will highlight the whole row and the object will highlight "Lime Green" in the map window.
7. Click the **"Add Selected Polygons"** in the "Interior Polygons" area.
8. If you select the incorrect object, click **"Clear Polygon Collections"**.
9. Once the **"Multi-Polygon Builder"** windows are populated correctly. Go to the "Destination Layer" drop down and Select the SHP location you want to save the "Merged Boundary" (poly-polygon). *Note: you may want to save the new object to a "NEW LAYER"*

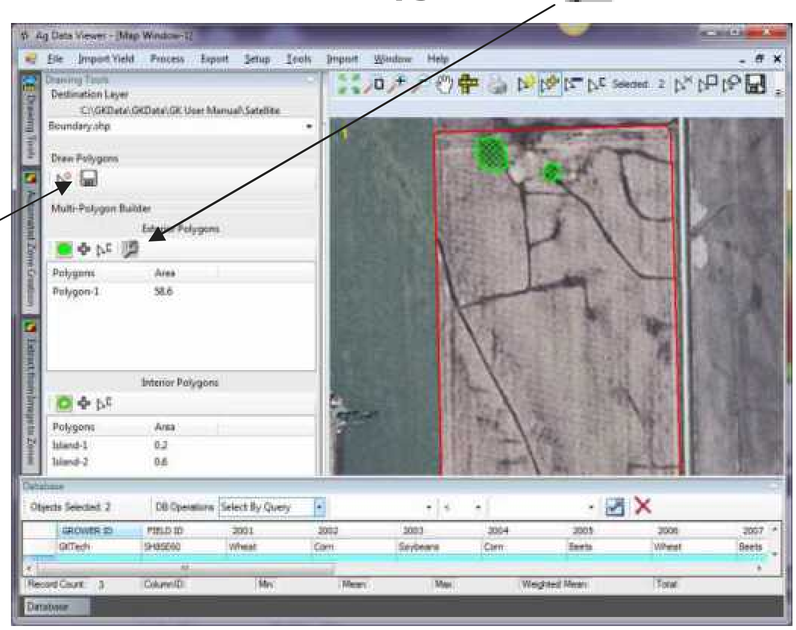


10. With the correct Layer, click **"Merge Interior and Exterior Polygons to Poly Polygon"** in "Exterior Polygons" area. 
11. Notice the "Database" has gone to just ONE object in the table.

12. IT IS VERY IMPORTANT THAT THESE OBJECTS ARE DRAWN & LISTED CORRECTLY.

13. If all is correct, click **"Save"** under the "Draw Polygons" area.

Note: The "Save" is a Save As process so you will have the option to "Re-Name"



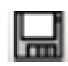
Drawing Layers (Polygons, Lines, & Points)

GK Drawing Tools - Hand Drawing (Lines & Points)

- Lines

1. Typically, we like to draw this data off of either field collected data points or 1-3 meter ortho-images (Geo-Referenced very well).
2. Zoom into the field as close as possible (all parts of the field must be visible).
3. At the bottom of the "Data Tree" Select **"Create New Layer From Template"**. 
4. Select **"Tile Line"** from the list.
5. Check the **"Tile Line"**. 

6. Click on the **"Draw a New Object"** button on the "Bottom Toolbar"

7. In the Map Window area, follow the instructions at the top.
   Drawing Tool Selected, Left Click each Point, to Define the New Object, Right Click to Finish
   Note: if you make a mistake while drawing—Hold Down the "Alt - Key" and "Left Click" to undo last point.
8. For the Polygon & Line tool, "Right Click" to finish the object.
9. Repeat the previous 3 steps adding all the lines you need.
10. Click **"Save"** on the "Bottom Toolbar". 

- Points (Single Point Drop)

1. Typically we like to draw this data off of either field collected data points or 1-3 meter ortho-images (Geo-Referenced very well).
2. Zoom into the field as close as possible (normally want to see the whole field).
3. At the bottom of the "Data Tree" Select **"Create New Layer From Template"**. 
4. Select **"Sample Points"** from the list.
5. Check the **"Sample Points"**. 

6. Click on the **"Draw a New Object"** button on the "Bottom Toolbar"

7. Left click where the point is to be placed.
8. Repeat the previous 2 steps adding all the points you need.
9. Click **"Save"** on the "Bottom Toolbar". 

Drawing Layers (Polygons, Lines, & Points)

GK Drawing Tools - Hand Drawing (Multi-Point)

- Points (Draw Multiple points)

There are time you may want to mark many points on a field. In these cases you will NEED to have a "Surface.grd" or "Surface.bmp" built for the field. In this example "Zones ID.grd"

1. Select your Grower / Farm / Field
2. Check on the Surface.grd (ex. Zones ID.grd) (This tool will NOT work without a SURFACE Checked)
3. At the bottom of the "Data Tree" Select "Create New Layer From Template".
4. Select "Sample Points" from the list.
5. Check the "SamplePoints.shp" in the "Data Tree" 

6. Click "Multi Point Draw Tool" on the bottom toolbar below your map window. (this is a toggle on/off)

7. Click out the points in the order you would want them sampled and in the spot you want sampled.

8. When you are finished deselect the "Multi Point Draw Tool" your new points will automatically save.

9. You now should have your custom points that look similar to the image below.

10. Once finished click "Save" on the bottom toolbar.

Drawing Layers (Polygons, Lines, & Points)

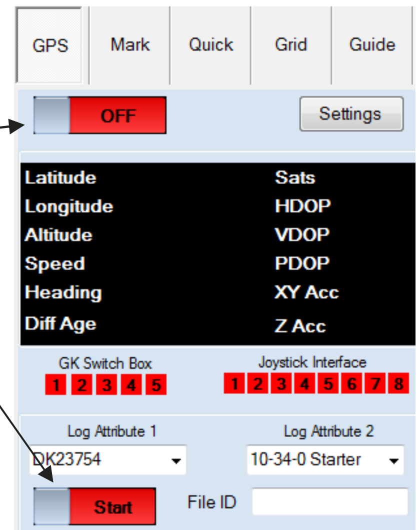
Collect with GPS Using Ag Data Mapping Solution (Map Window)

1. Turn on all layers you want to view for background maps
2. Check on "EXISTING" "Boundary" or "Ditch Line" or "Sample Point" if you want to add to Existing data.

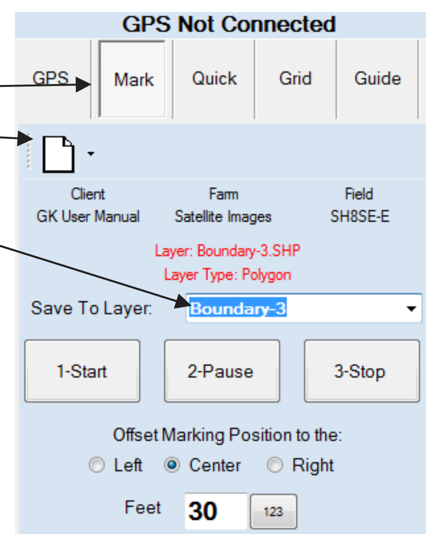
- Connect GPS

1. Go to the **"GPS Mark"** tab.
2. Click **"Connect GPS".**
3. For Topography collection, check **"Start Logging".**

NOTE: if "Logging" is ***"ON"*** *you* ***WILL NOT*** *be able to turn on or off Layers or Data.*



- Marking Data



1. Go to the **"Mark"** tab.
2. For New Shape File **"Create Layer From Template".**
3. For "Existing SHP" files, Click "**Save To Layer**"
4. Click **"Start".**
5. **"Pause"** will allow you to drive around un-drivable are-as - **"Continue"** button will appear.
6. Click on **"Stop"** once you have reached your finish point.
7. The object will automatically "Save".
8. Repeat steps 1-6 drawing in all the Interior & Exterior Boundaries for this field.
9. To view acres, make sure the object is the "**Active Layer**". "Double Click" on the object - or click on the **"Database"** tab for acres.
10. For fields with no interior boundaries, you are finished.
11. For Interior Boundaries, go back two pages "**Exterior/Interior Polygons (Creating PolyPolygon)"** section

** More GPS information in the "Using GPS Controls" Section of the manual. **

Drawing Layers (Polygons, Lines, & Points)

Decomposing a Poly-Polygon

Some boundaries may come in or have been built as Poly-Polygons. These interior polygon may need to be removed. These instructions will show you how to do this. This example will show how to remove 2 tree rows from a field.

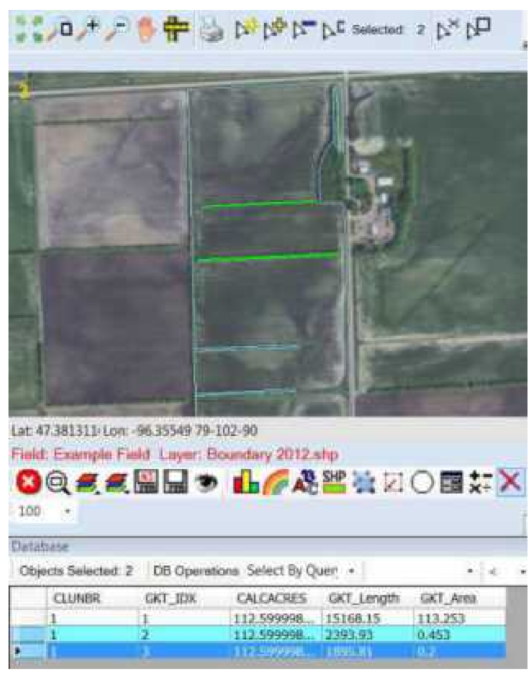
1. Turn on our Poly-polygon boundary (note I turned on NAIP for this example)
2. Click inside the Boundary (making it a "Selected Object" - **Lime Green**)
3. On the bottom toolbar click on the "**Decompose a selected PolyPolygon to its component Polygons**"
4. This is a good time to do a "Save As" & Re-Name (ex. Boundary 2012.shp)
5. Make sure the active layer is Boundary 2012.shp
6. Select the polygons to remove. (either by Clicking in them or using the Database)
7. Click on "Delete Selected Objects" button on bottom toolbar.
8. Click "Save" on the bottom toolbar.

Boundary as Poly-Polygon

Only has 1 Database entry

Note : The Database of each object.

Boundary as Multiple Polygon



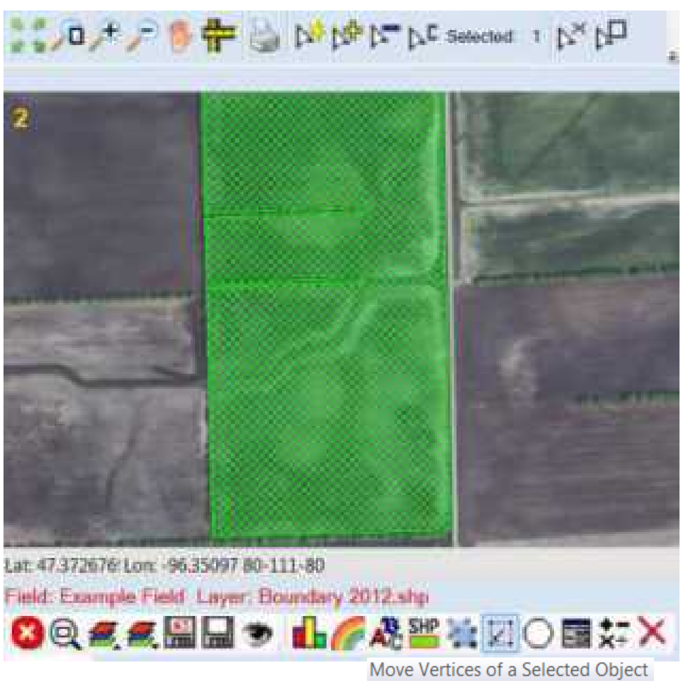
Has multiple database entries

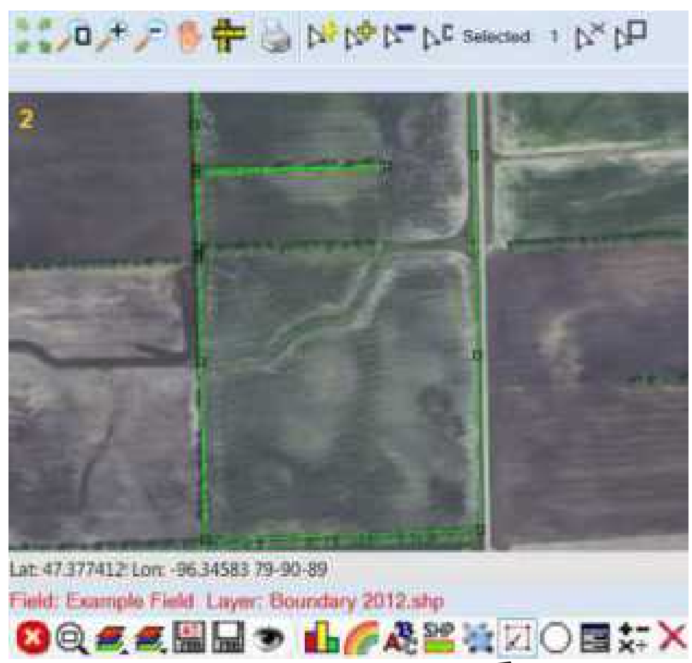
Drawing Layers (Polygons, Lines, & Points)

Moving Vertices or Moving Points

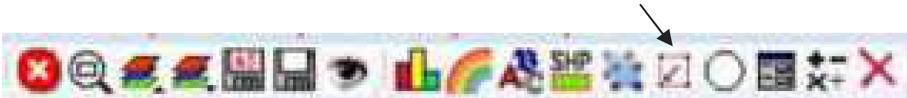
Some Points / Lines / Polygons may have imperfections in one or two areas that are drawn incorrectly. These objects may not need to be totally redrawn. There is a tool for moving these vertices and points. These instructions will show you how to do this. This example will show how to remove 2 tree rows from a field boundary.

1. Turn on Points / Line / Polygon SHP file that needs to be edited (polygon in this example)
2. Click on or in a single object to edit (making it a “Selected Object” - **Lime Green**)
3. Bottom toolbar click on the “**Move Vertices of a Selected Object**” button to turn it “On”. 
   Note: This is a “Toggle On/Off button”
4. Move your Cursor over one of the “Vertices” or “Point” you will get a “4-Way Pointer” and Left Click.
   Note: Lines and Polygons will break down to show all vertices.
5. To move one of “Vertices” or a “Point” and left click hold and move
   Note: Holding the “CTRL” button and a “Right Click” will add a vertices
   Holding the “ALT” button and a “Right Click” will delete a vertices
6. Click on the “**Move Vertices of a Selected Object**” button to turn it “Off”. 
7. Repeat steps 2-6 as needed on any other object in this SHP file.
8. Click “Save” on the bottom toolbar.





Make sure you “Turn Off” the “Move Vertices” (shown below)



My Notes

My Notes

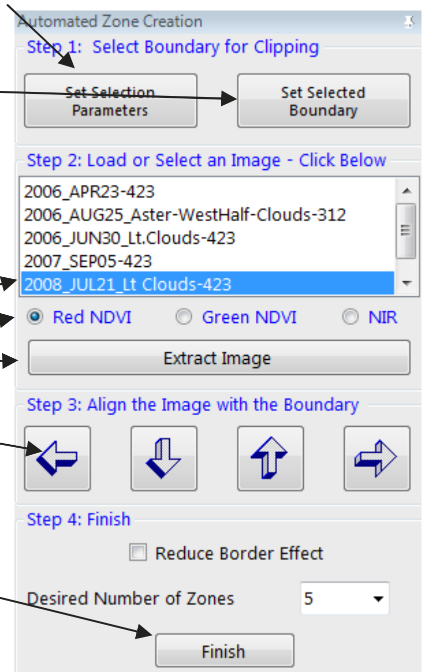
Quick Notes For Satellite Imagery

Creating Boundaries and Guidelines

1. Draw a field boundary or save it from a CLU file. Refer to creating boundaries section.
2. Turn on a NAIP image (County Data)
3. Create a new line file.
4. Draw reference lines from the NAIP image. This will be used to help georeference the satellite imagery.

Selecting Polygon - Boundary

1. A Boundary is needed for this process. Refer to the creating boundaries section to create a Boundary.
2. Turn on Boundary.shp and make sure it is the **active layer**.
3. Go to the "**Automated Zone Creation**" Tab—Click "**Set Selection Parameters**"
4. Click inside the Boundary.shp polygon in the "Map Window"
5. The object will appear **"Lime Green"**.
6. Go to "**Automated Zone Creation**" tab—Click "**Set Selected Boundary**"
7. Go to the "Automated Zone Creation" Tab

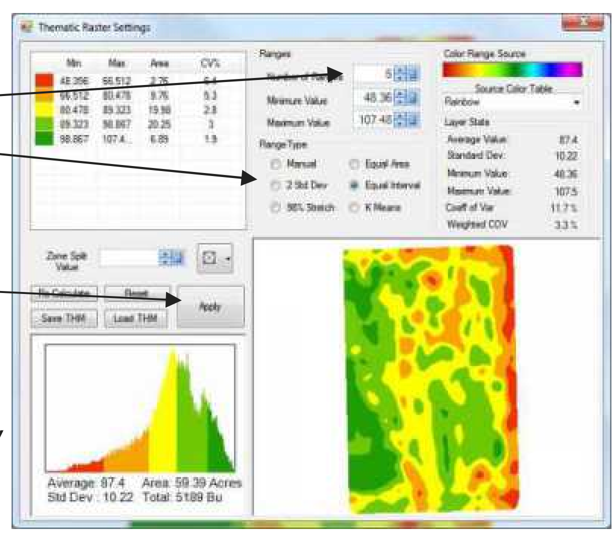


Cutting the Raster

1. Turn on All the Satellite images you want under **(Imagery Tab)**.
2. Turn on the Guidelines that were created.
3. "**Automated Zone Creation**" Tab-Click on the Image Date to extract
4. Choose the "Extraction Type" Red NDVI=Vegetation/NIR=Bare Soils
5. Click "Extract Images"
6. Use the Alignment Arrows to move Image (if needed) according to guidelines
7. Choose "Desired Number of Zones"
8. Click "Finish" (Repeat 2-7 for all the Images)

Coloring & Zoning Raster

1. Make sure your zone.grd is the **active layer**.
2. Useful tools at this time (if needed)
   - **"Reduce Border Effect"**
   - **"Trim End Values"**
   - **"Invert"**
3. Click on **"Smooth Filter"** 5x5 - two times
4. Turn all images to be merged. Open **Multi Output Map Math**
5. Open "Average Of All Layers" script => Compile => Run
6. "**Save As**" Zones.grd
7. Click on **"Thematic Color"**
8. Adjust **"Number of Ranges"** to desired zone #
9. Adjust the settings like the window to the right
10. Normally use "2 Std Dev" or "K Means".
11. Mouse over the "Color Chips" to adjust and use the "Scroll Wheel" on the mouse for custom coloring.
12. When finished, click **"Apply"**.



Saving for—Soil Sampling

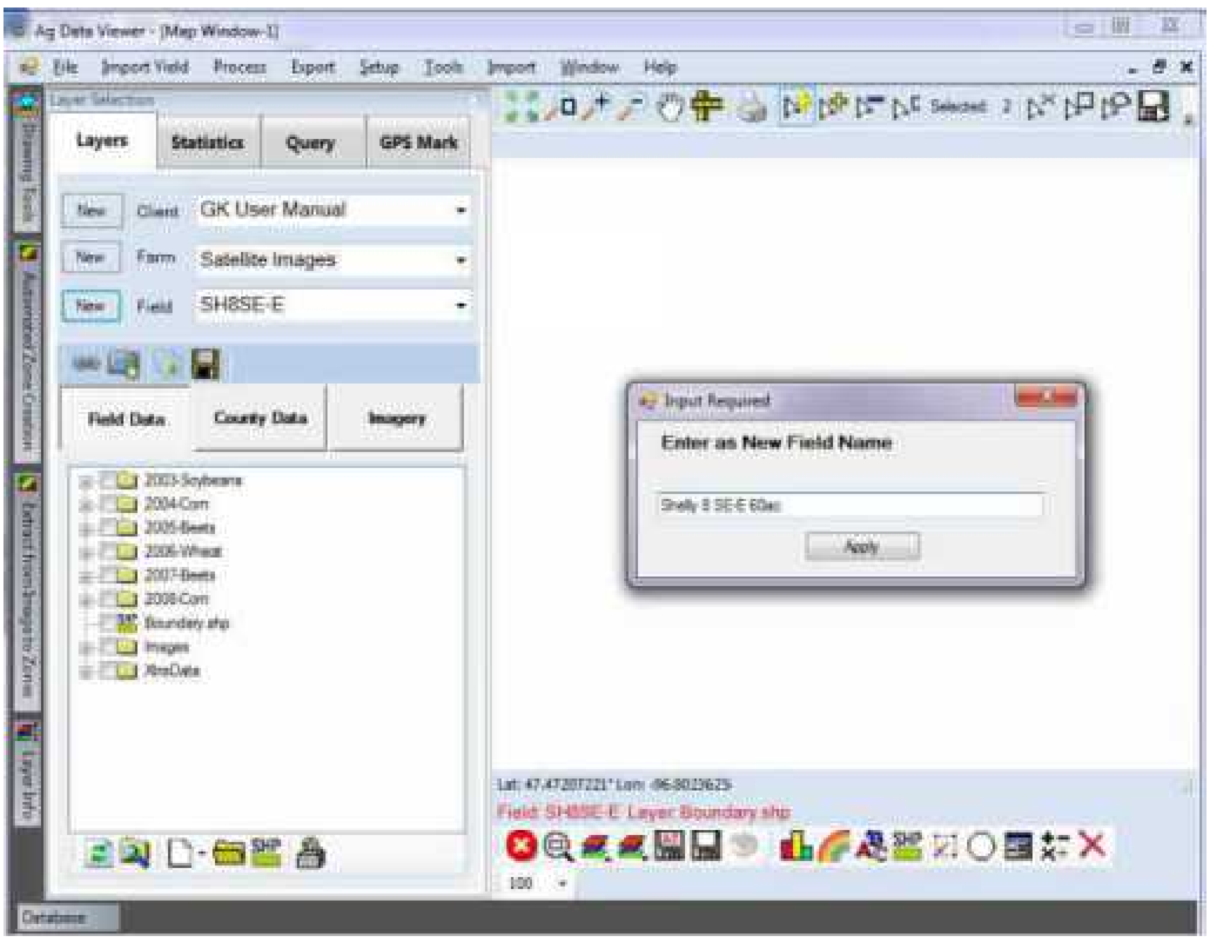
1. Right click on the file name.grd in the data tree and select save as BMP (most soil samplers) /// save as Google Earth KMZ /// Or go to "File" & "Print Map" & "Print Map to Bitmap"

Creating Zones From Imagery

For this section of the help guide, we will be looking at Extracting and Handling Imagery. In the reference to “Handling” Imagery, we refer to colorization and zone creation. We will be working in the New Map Window, but many of these tools will carry across into other windows in Ag Data Mapping Solution.

1. Start up Ag Data Mapping Solution and select the **“Map Window”**  button.

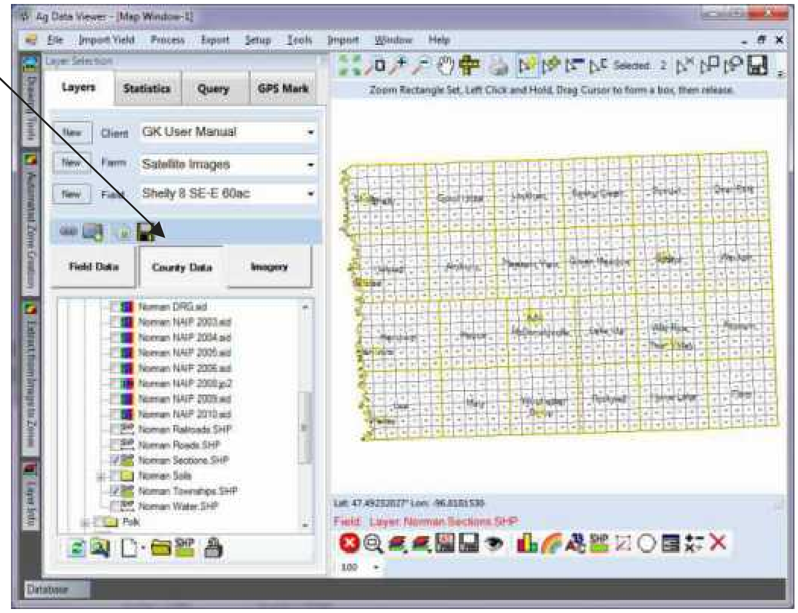
2. When the **“Map Window”** opens, select the desired “Grower”, “Farm” and “Field”. If they do not exist, click on the “New” buttons to the left of the name. An **“Input Required”** window will open up in the middle of the screen to enter the new name, do so, and click “Apply”. Now you have your field selected.



Creating Zones From Imagery

Creating Boundaries

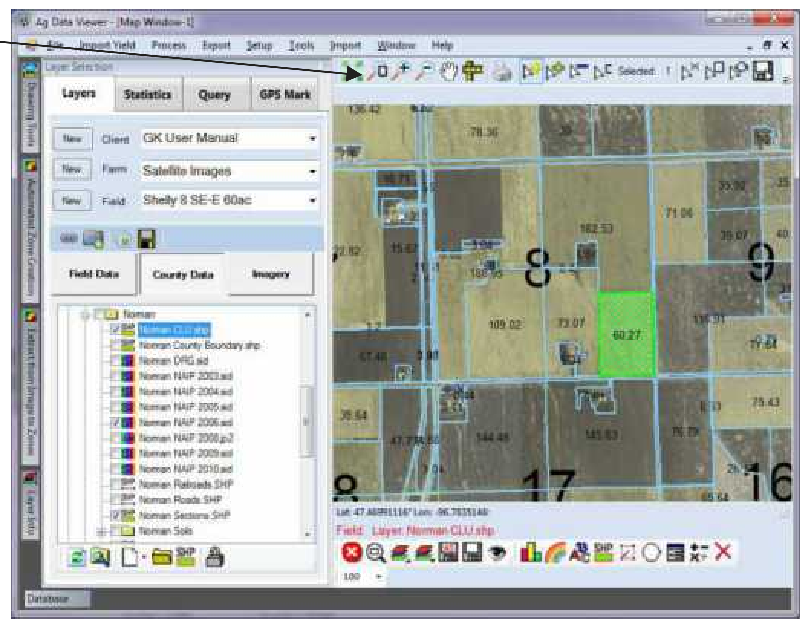
1. Select the "County Data" tab in the "Layer Control" area on the left side of the window. Open up the "County" folder you want and turn on a "NAIP" file, a "Township" file, a "Section" file and a "CLU" file if you have one.
2. If you already have a boundary created or have a "CLU" and do NOT want to create an individual field boundary, skip to the Automated Zone Creation or the Manual Zone Extraction section.



3. Using the Township and Section data, use the zoom tools on the top tool bar to find the desired field.

4. Once zoomed to the desired field, boundaries can be created two different ways in the office:

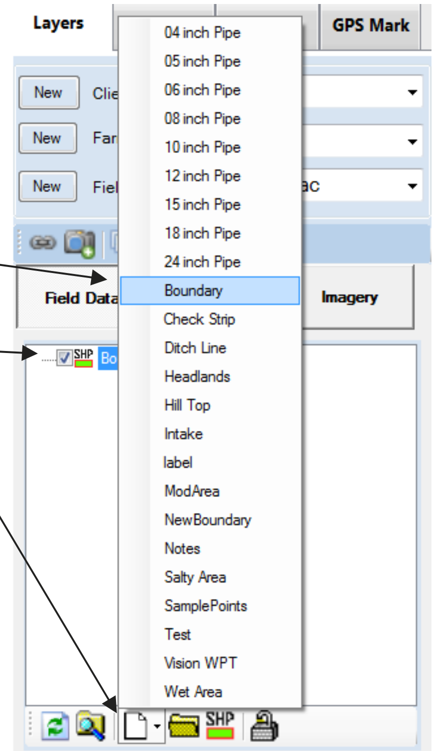
   - **Draw a Field Boundary**
   - **Save Boundary from a CLU**



Creating Zones From Imagery

Creating Boundaries

Hand Draw a Field Boundary

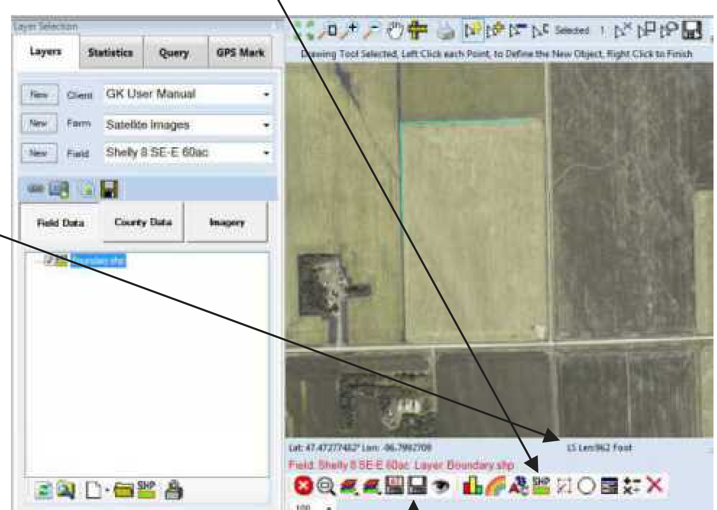


1. Make sure all the correct Grower, Farm, Field data is selected and go to the bottom of the "Data Tree" window and click on **"Create New Layer from Template"** and select "Boundary".

2. You will see the "Boundary" file you created under the "Field Data" tab. Check the box in front of the file name **"Boundary.shp",** this will make it the Active Layer.

3. Go down to the bottom tool bar and select the **"Draw New Object"** button.

4. Once this is selected, "Left Click" on the field edge. Notice the blue line dragging behind the cursor. The line will not draw until you "Left Click" again at your next location (*If you mark a point at an incorrect position, hold down the "ALT" key and left click to undo your last point marked*). Once you finish going around the field, "Right Click" to complete the drawing. When you "Right Click", the software will close the boundary by snapping the line back to the first point marked.
   a) Take note that as you draw a line, there is a tool at the bottom – center of the screen to help you. Giving you the line lengths and headings to help guide you.

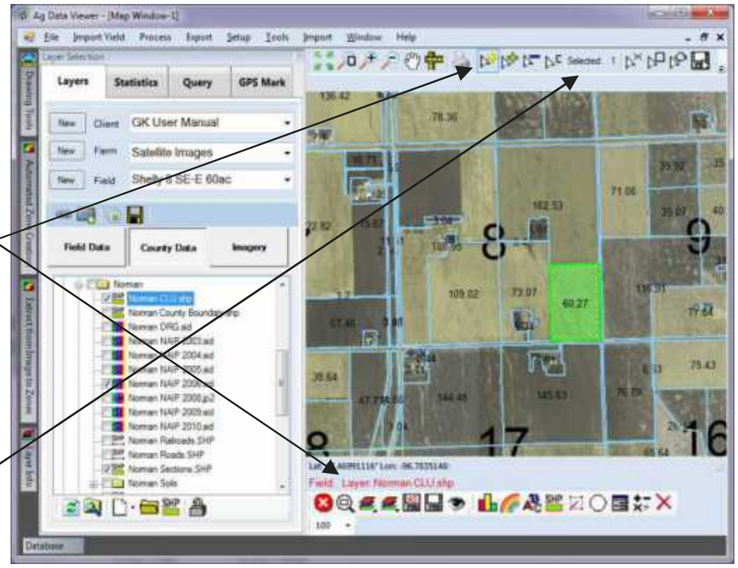


5. Once you have finished creating your boundary, save the boundary by selecting **"Save"** on the bottom toolbar. This will open a save window - click on "Save".

Creating Zones From Imagery

Creating Boundaries

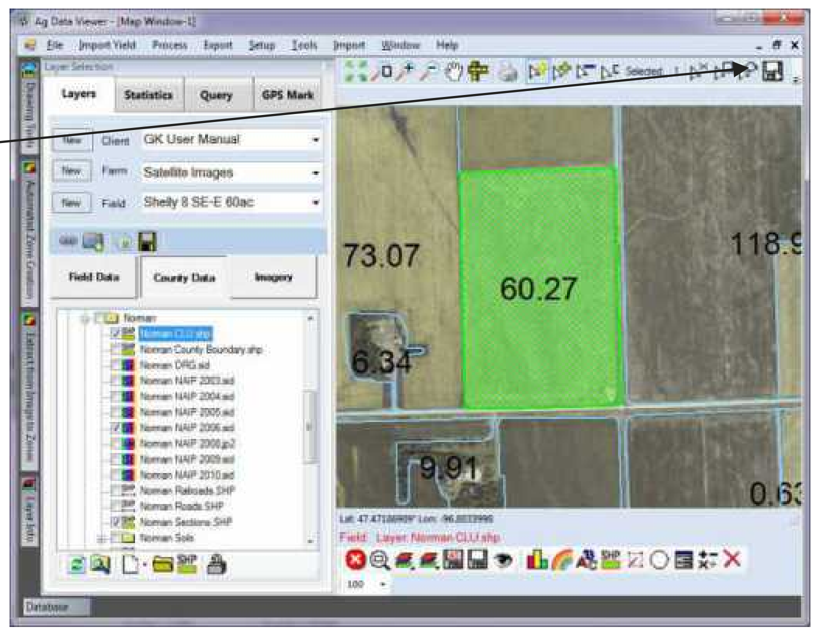
- Save Boundary from a CLU



1. Make sure the bottom active layers has the address of the CLU. Example- Layer: Norman CLU.shp

2. You need to select the polygon of the field you want to save. You will do this by clicking on the **"Select Mode Replace"** on the top tool bar and click inside of the polygon; it will appear **Light Green** to show it's selected (*Hold down your "Ctrl" key to select multiple objects*).

   *Note: the "**Selected**" on the top toolbar. Should match the # of objects selected.*



3. Select the **"Save Selected Objects to New Layer"** on the upper toolbar. Make sure you are saving in the correct location. "Name" the object (Example- Boundary FSA.shp) and "Save".

Creating Zones From Imagery

Creating Boundaries—Boundary Creation From Mass Collection

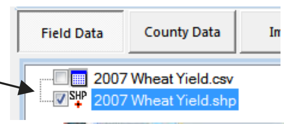
With some tools within ADMS boundaries can automatically be generated.

To automatically generate a boundary a point data collection is needed. This can be anything as long as it's point data. A few good sources are:

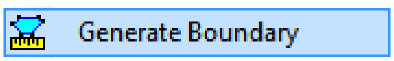
- Yield Data
- Elevation Survey Data
- As-Applied Data

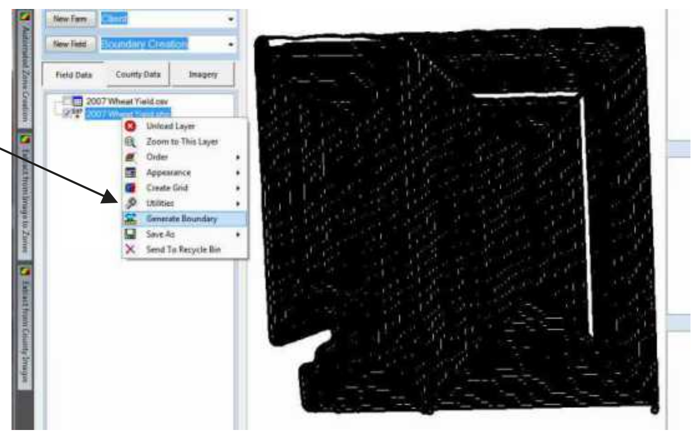
Make sure there are now outlier points in the collection otherwise this process will take much longer to run.

**Note: If yield is being used and has been cleaned up some of the data around the edge of the field may be missing and the boundary will be inaccurate. In this situation consider exporting the raw data for the purpose of boundary creation.*



1. Turn on a data points file (SHP or CSV).
2. Right Click on the field in the data tree and select **"Generate Boundary."**





3. After that is selected the "Generate a Boundary from Points" window will appear. This window gives instructions along with different options of how the new boundary will be created.

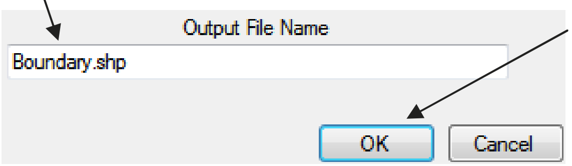
The two options on this window are the "Smoothness" and "Subset" values.

- **Smoothness Value**: How close the boundary follows the original points. The lower the value the smaller the search radius will be.
- **Subset Value**: How many points are used out of the whole collection. (e.g. If the subset value is set at 3, every 3rd point will be used during the calculation. Likewise, if it's set at 20 it will use every 20th point.)
- The boundary routine can be run multiple times before saving the final boundary. This allows you to adjust the smoothness and subset values.
- It is recommended to keep the subset value so it uses less then or equal to 10,000 points.

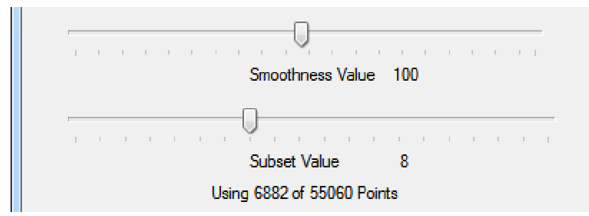
Creating Zones From Imagery

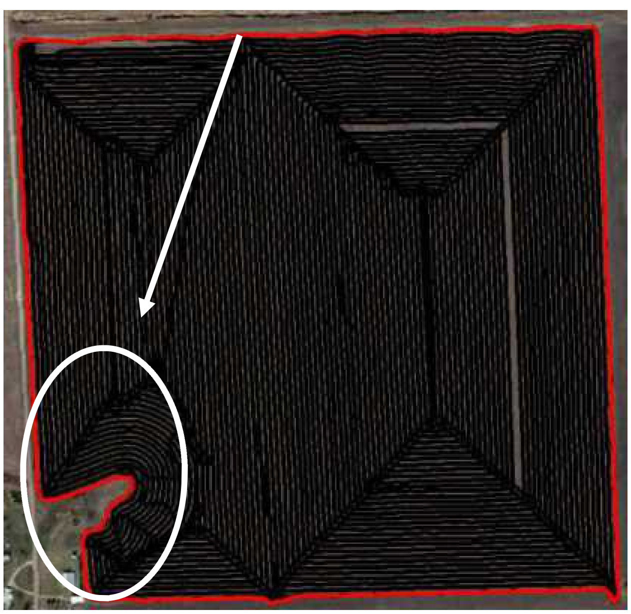
Creating Boundaries—Boundary Creation From Mass Collection

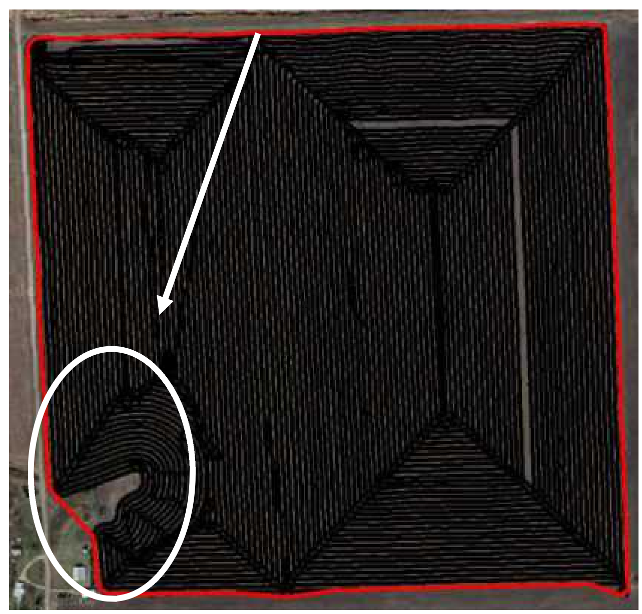
4. The smoothness and subset values will automatically be set by the software, but can be adjusted to change how the boundary follows the points.
5. Click "Run Boundary Routine" Run Boundary Routine
6. Adjust the "Output File Name" if needed. If the name is changed make sure the *.shp extension stays on. Otherwise the boundary will not be recognized in the software.



7. Click "OK"
8. The polygon will be saved back to the data tree with the entered file name.





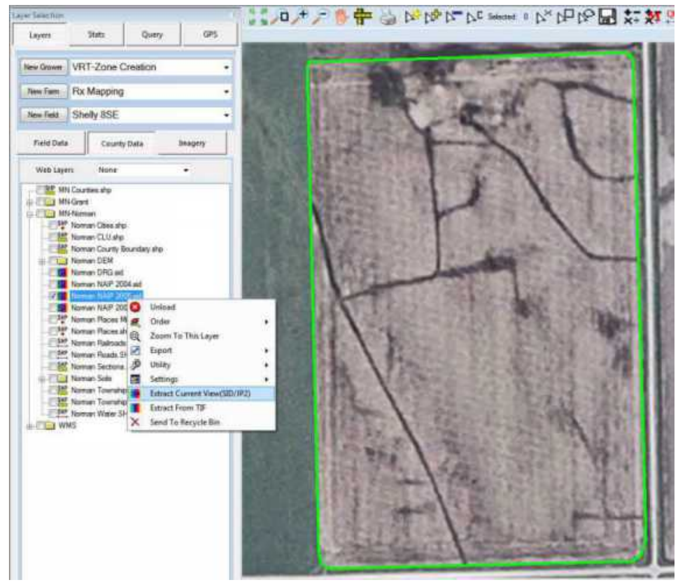


Final adjustments can be made to the boundary using the "Move Vertices" tool on the bottom toolbar.

- Select inside the boundary to turn it green.
- Select "Move Vertices of Selected Object."
- Hover over the vertices and left click and hold to move them.
- After all vertices are moved click the "Move Vertices of Selected Object" button again to turn it off.
- Save changes.

Extracting Images From NAIP

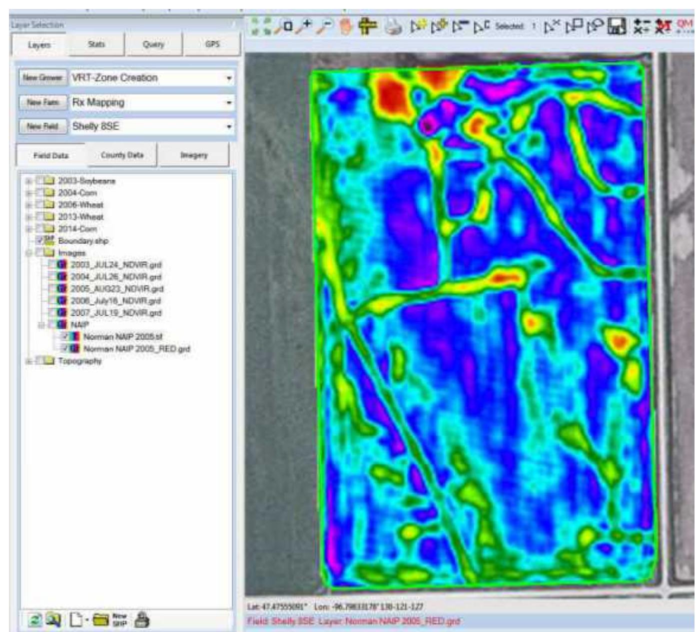
FSA—National Ag Imagery Program (NAIP) supplies us with high resolution .sid & .jp2 images. Typically 1 & 2 meter resolution. These instructions will walk you through converting a small area into a .tif format to create a surface for making "Zones". Keep in mind there is not a "NIR" channel in most of this data. So we are working with the "Red / Green / Blue" spectrum of visible light.



1. Turn on your "Boundary.shp"

   - Note: you must be zoomed to the "Field"

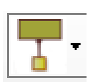
2. Go to the "County Data" Tab
3. Turn on a NAIP image.sid (or .jp2)
4. Right click on the "NAIP Image.sid" name
5. Select "Extract Current View (SID/JP2)
6. Go to your "Field Data" Tab
   - Refresh the data tree
   - Open "Images/NAIP" Folder
7. Check on the new "County NAIP.tif" make it the **active layer (in RED)**
8. Follow the image extraction instructions Using - "Manual Extractions"

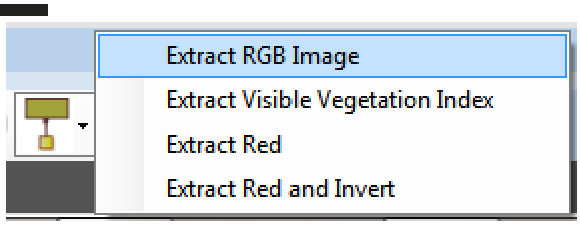


<u>Consultant Users:</u>

1. Turn on your "Boundary.shp"

   - Note: you must be zoomed to the "Field"

2. Go to the "County Data" Tab
3. Turn on a NAIP image.sid (or .jp2)
4. Click the extract from SID/JP2 icon 
5. Several different options will appear in a list.



6. Choose the appropriate extraction method
7. Go to the "Field Data" tab
   - Refresh the data tree
   - Open "Images/NAIP" Folder
8. The extracted file will have an extension on it to define the extraction type (ex: _Red, _RGB_VisVI)

Extracting Images From Web Layers

Starting at ADMS version 7.0.0 there is added functionality to give users access to web based background imagery.
In order to use these options, the computer must have an active internet connection. This allows the software to connect to a WMS (Web Map Service) server. Once the connection is made a geo-referenced background is returned to be viewed in the Map Window.

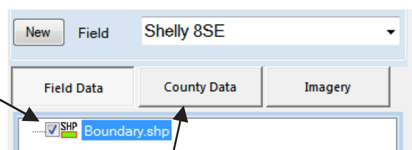
There are two main types of WMS layers that are handled in ADMS.

1. Built in ADMS WMS links
    - These links will be standard within the software. The user has no ability to change, add, or remove them. Examples would be Google & Bing Maps and cover a bigger geography including the United States and Canada.

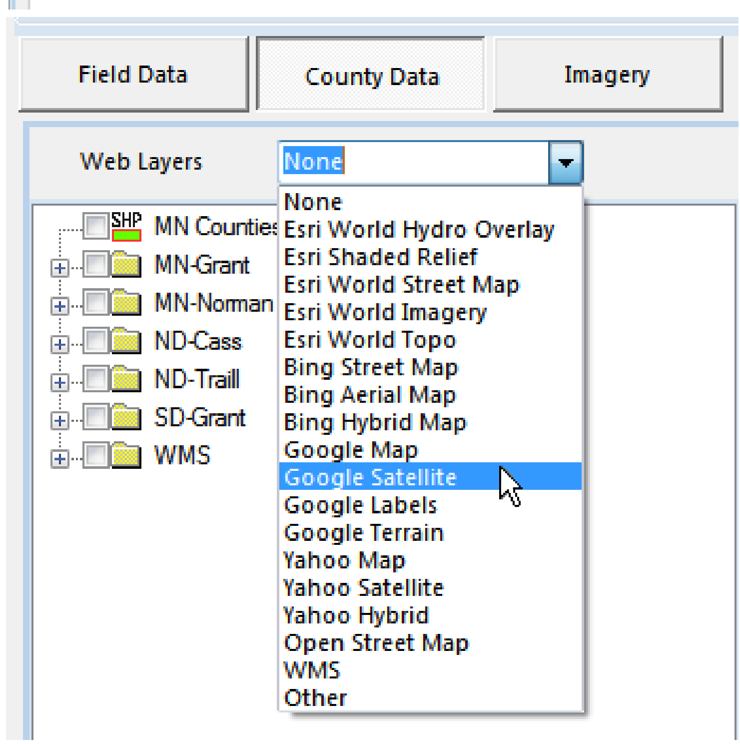
2. Local/Specialty WMS links
    - WMS links that the software user can change, or may have special access to. These may be limited to a specific state or region. The links will be stored in the county data folder and visible in the data tree.

Using ADMS Web Layers

1. Turn on a layer to be used as reference layer. This will bring ADMS to the field level instead of loading the entire country. (e.g., boundary or surface of the field)



2. Select the **"County Data"** tab.



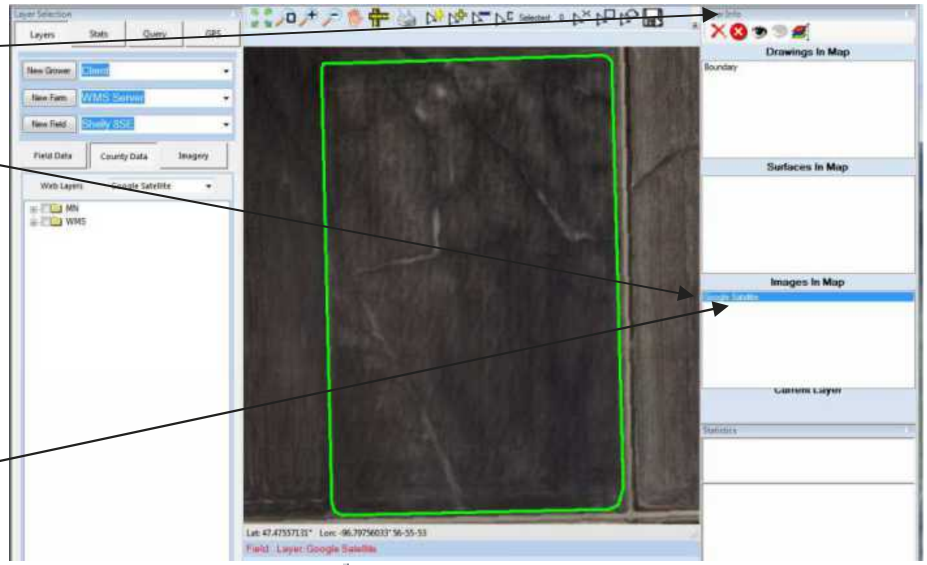
3. From the **"Web Layers"** drop down menu there will be a list of available layers to select.

4. Select on the layer to be used as the background image. After the desired layer is selected from the list it will load on the back of all layers that are currently loaded in ADMS.

**Note: If another image is currently loaded in the software the web layer may not be visible since by default it is loaded behind all other layers.*

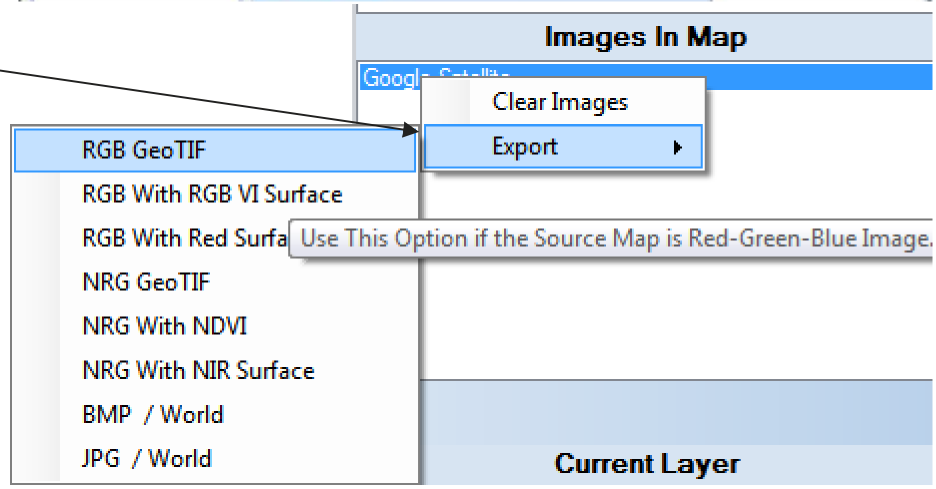
Extracting Images From Web Layers

Using ADMS Web Layers—Saving & Extracting Images



5. In the **"Layer Info"** panel under **"Images In Map"** the web layer will appear.

6. To save this layer to use offline or for zone creation **Right Click** on the layer name (e.g. Google Satellite).



7. After right clicking choose **"Export."** A menu will appear with several different extraction methods.

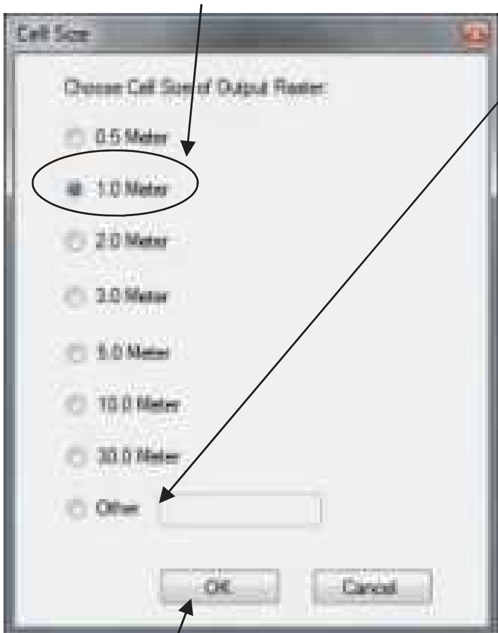
*To use the surface extractions the boundary **MUST BE SELECTED** first.

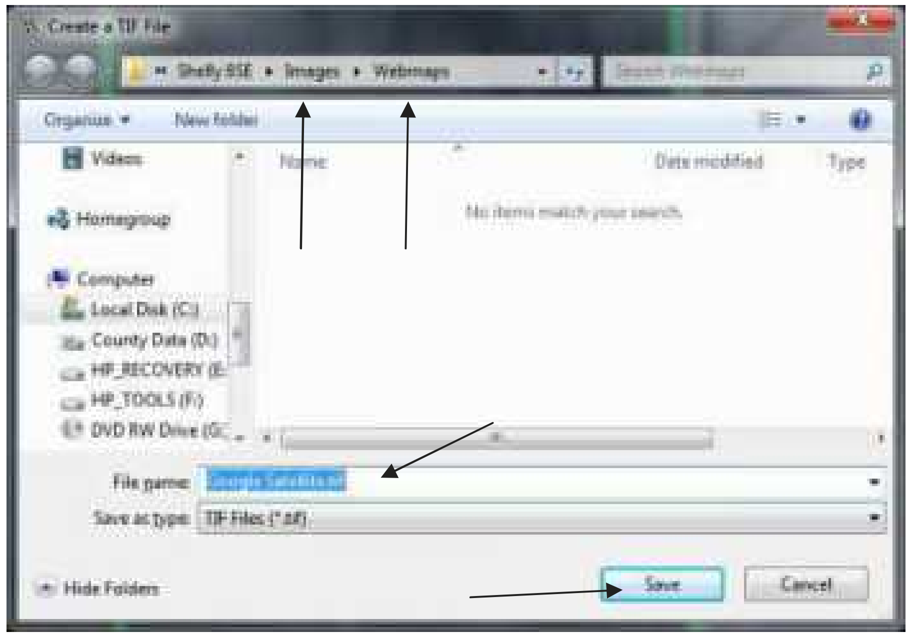
- **RBG (Red, Green, Blue) GeoTIF**—Extracts the true color image as a TIF file. It is very important that this is chosen correctly otherwise certain extractions (NDVI, NIR, RGB VI) may not work correctly
- **RGB With RGB VI Surface**—Extracts the true color TIF file and it extracts and saves the RGB VI(Red, Green, Blue Visual Index) as a GRD map to the "Field Data."
- **RGB With Red Surface**—Extracts the true color TIF file and the Red band is extracted and saved as a GRD file.
- **NRG (Near Inferred, Red, Green) GeoTIF**—Use this option if there is an inferred band in the image. Usually you can tell if the image has a reddish color to it. This will save it as a color inferred GeoTIF in "Field Data." It is very important that this is chosen correctly otherwise certain extractions (NDVI, NIR, RGB VI) may not work correctly
- **NRG With NDVI**—Extracts the NRG GeoTIF and a NDVI GRD is created and saved in "Field Data."
- **NRG With NIR Surface**—Extracts the NRG GeoTIF and the NIR band is extracted and saved as a GRD in "Field Data."
- **BMP / World**—Saves the file as a geo-referenced BMP file.
- **JPG / World**—Saves the file as a geo-referenced JPG file.

Extracting Images From Web Layers

Using ADMS Web Layers—Saving & Extracting Images

8. After choosing the extraction option you wish to use a box will appear asking which resolution to export it as. The higher the resolution the less detailed the image will be. For most field situations 1-2 meters is adequate. By choosing "Other" a custom size can also be entered.



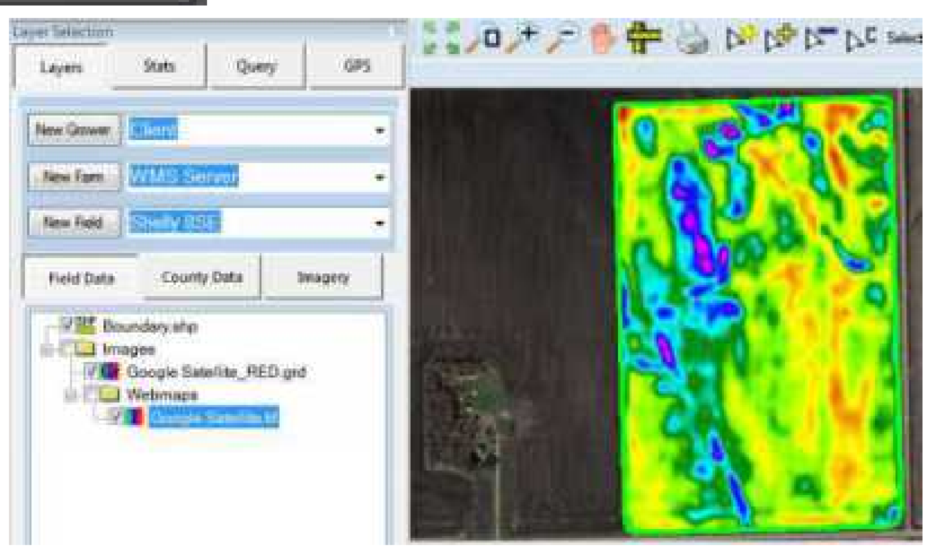


8. Click **"OK."**

9. The file will by default be saved back to the "Field Data" and be placed in "Images/Webmaps." If desired the TIF file can be renamed in this window.
10. Click **"Save"**

11.The image can also be saved by using the buttons on the bottom toolbar.

11. If a surface was extracted it will have the extraction type as an extension on the file name. Such as _RED.

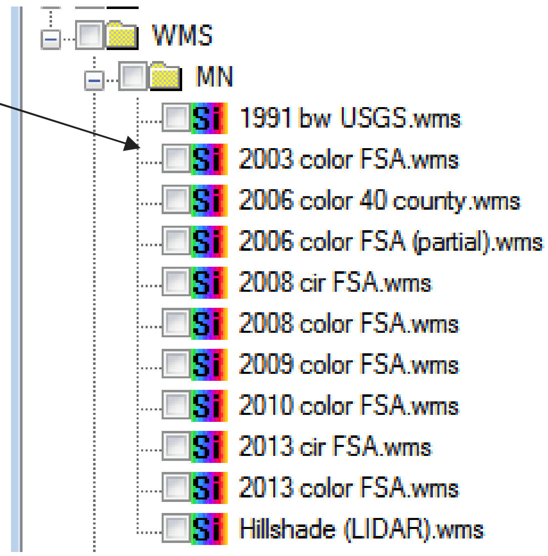


Extracting Images From Web Layers

Using Custom WMS (Web Map Service) Layers—Saving & Extracting Images

There are many different WMS layers that may be added into ADMS as an additional layer and be utilized within the software. Often these layers are state or region specific and require some setup before they can be used. To set up WMS layers refer to that section in the book.

- Once the WMS layers have been properly set up they will show up as an additional layer in the data tree just like a SID or TIF file.
- The example on the right shows an example of some different layers that are available through the Minnesota WMS server.
- These layers can be placed in folder structures, emailed, and are treated like other layers that ADMS automatically recognizes.



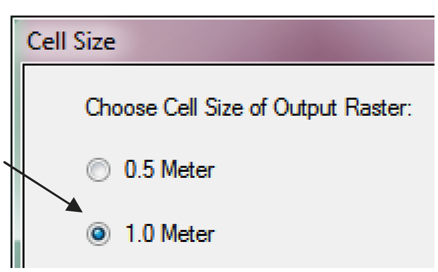
- Turn on a boundary or reference layer to bring ADMS to the field level.
- Turn on the WMS layer to be extracted.

There are several different ways that the layer can now be extracted.

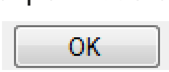
1) Right clicking on the layer in "Layer Selection."

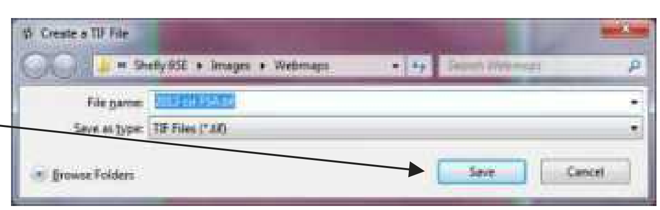
This brings up 3 different extraction options:

1. TIF/World—Saves the image as a TIF file. This is recommend for image processing and zone creation.
2. BMP/World—Saves the image as a geo-referenced BMP file.
3. JPG/World—Saves the image as a geo-referenced JPG file.



- Choose the output resolution. For most field situations 1-2 meters is adequate.
- Click "OK."
- The file will automatically be named and saved back to the "Field Data" file structure.
- Click "Save."

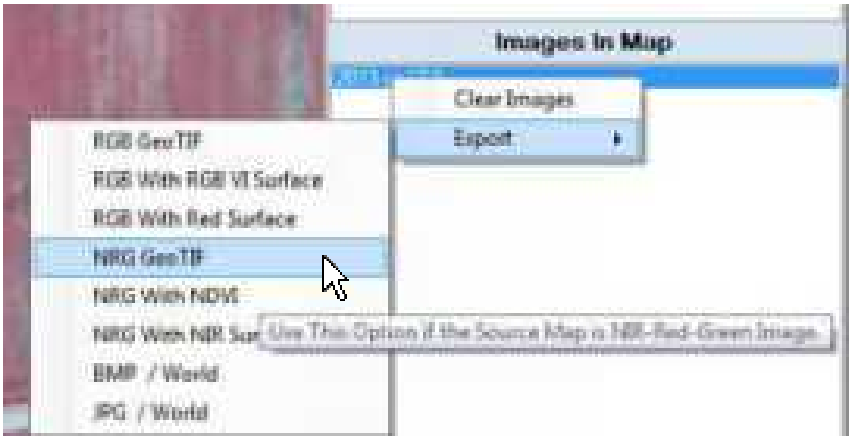




Extracting Images From Web Layers

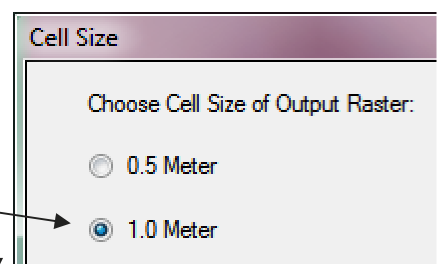
Using Custom WMS (Web Map Service) Layers—Saving & Extracting Images

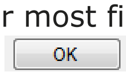
2) Right clicking on the layer in "Layer Info."



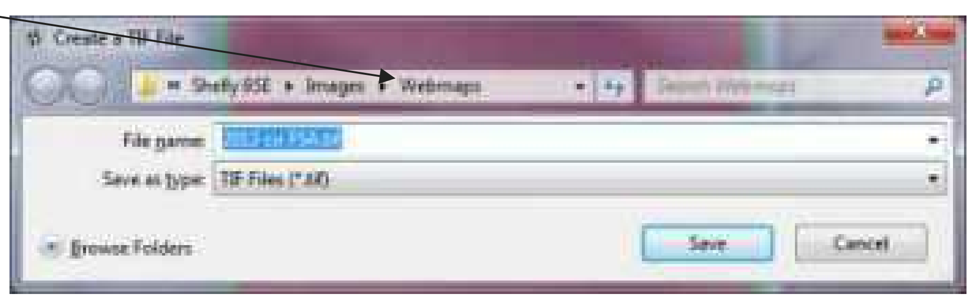
- This gives you several different extraction options. If the RGB VI, Red Surface, NDVI, or NIR Surface is used the boundary **MUST BE SELECTED** first.

* **RBG (Red, Green, Blue) GeoTIF**—Extracts the true color image as a TIF file. It is very important that this is chosen correctly otherwise certain extractions (NDVI, NIR, RGB VI) may not work correctly
* **RGB With RGB VI Surface**—Extracts the true color TIF file and it extracts and saves the RGB VI(Red, Green, Blue Visual Index) as a GRD map to the "Field Data."
* **RGB With Red Surface**—Extracts the true color TIF file and the Red band is extracted and saved as a GRD file.
* **NRG (Near Inferred, Red, Green) GeoTIF**—Use this option if there is an inferred band in the image. Usually you can tell if the image has a reddish color to it. This will save it as a color inferred GeoTIF in "Field Data." It is very important that this is chosen correctly otherwise certain extractions (NDVI, NIR, RGB VI) may not work correctly
* **NRG With NDVI**—Extracts the NRG GeoTIF and a NDVI GRD is created and saved in "Field Data."
* **NRG With NIR Surface**—Extracts the NRG GeoTIF and the NIR band is extracted and saved as a GRD in "Field Data."
* **BMP / World**—Saves the file as a geo-referenced BMP file.
* **JPG / World**—Saves the file as a geo-referenced JPG file.



- Choose the output resolution of the extracted image. 1-2 meters is adequate for most fields.
- Click "OK." 

- The file will automatically be named and saved back to "Field Data" in a "Images/Webmaps."
- Click "Save."
- If a surface was extracted it will have the extension of the extraction type on the end of the file name. (_NIR, _NDVI)



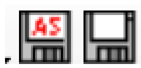
Extracting Images From Web Layers

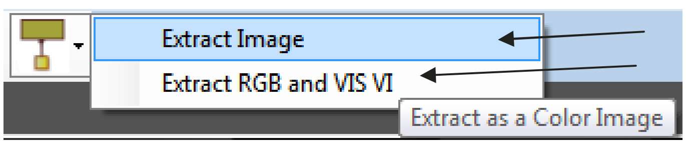
Using Custom WMS (Web Map Service) Layers—Saving & Extracting Images

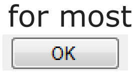
3) Using the Bottom Toolbar

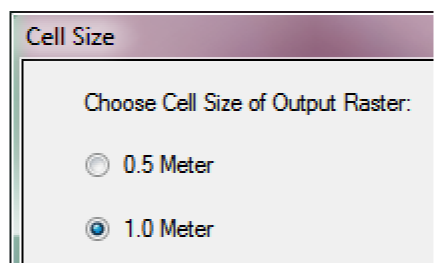
- Make the WMS layer active by clicking on it. It will show up in red below the Map Window.

- There are 3 buttons that will allow the image to be saved to a new layer.

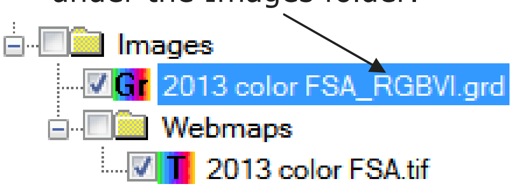
1. The Save & Save As buttons. 
   - When a web layer is active these buttons do the same thing and save the image to a new layer. The Save & Save As buttons will only save the image as a TIF file. It will not create any surfaces.
2. The Extract Image button. 
   - Only use this options on RGB or true color images.
   - This allows the image to be either Extracted as a TIF or Extracted as a TIF & Extracted as a RGB VI surface. If the image is a CIR (Color Inferred) use the second extraction method by right clicking on **"Layer Info."**

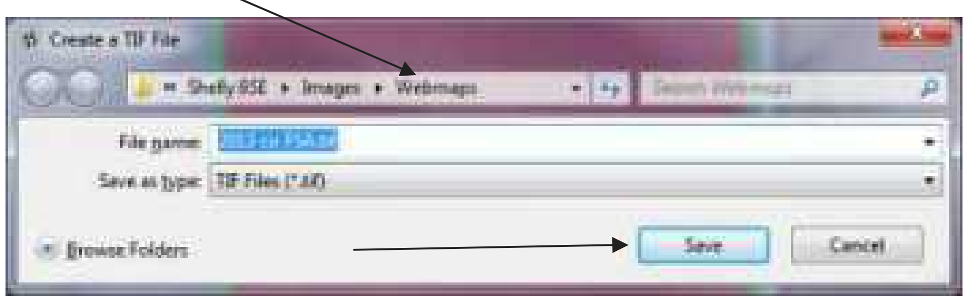


- Choose the output resolution of the extracted image. 1-2 meters is adequate for most fields.
- Click "OK." 
- The file will automatically be named and saved back to "Field Data" in a "Images/Webmaps."
- Click "Save."



- If the Extract image button is used and an RGB VI surface is extracted it will have the extension _RGBVI in "Field Data" under the Images folder.





Creating Guide Lines for Extracting Imagery (Landsat)

As you may know if you have ever worked with Landsat data it is low resolution (30 meter raw data). The geo-referencing is ok at best. So you must use the tools in the software to “align” the data. Clicking between images can be time consuming, but it is very accurate. If you are going to be extracting many images on a field using Landsat data. Suggest looking at using “Guide Lines”.

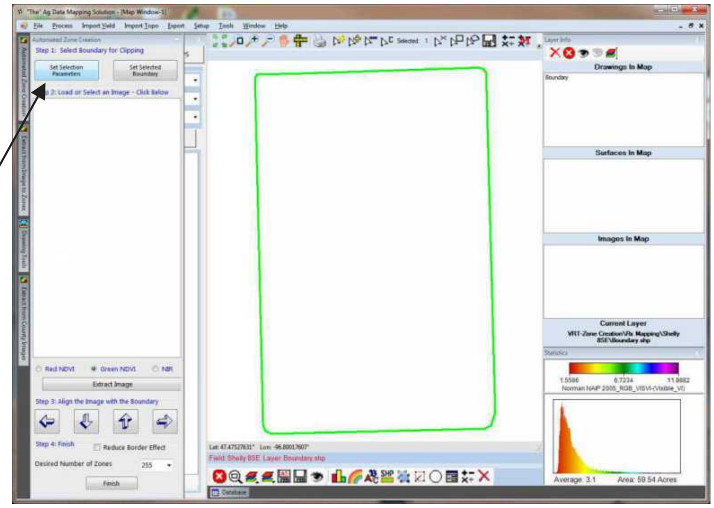
1. Turn on Field Boundary
2. Turn on a NAIP image that has all the “*details”* you would want to highlight.

   Prefer to use extracted NAIP.tif files (see previous page).

   Details Like: ditches / sandy knob & veins / salty spots / clay knobs
3. Click on the “Create Layer from Templates” below the data tree.
4. Choose “Guide Lines”
5. Check the “Guide Lines.shp” file
6. Click on the SHP button on the bottom toolbar
7. Draw in all these areas, reminder you are drawing LINES not Polygons
8. Repeat 6 & 7 as needed to highlight all events
9. Click the “Save” button
10. Leave the “Guide Lines” on while extracting Landsat Images. Very helpful..

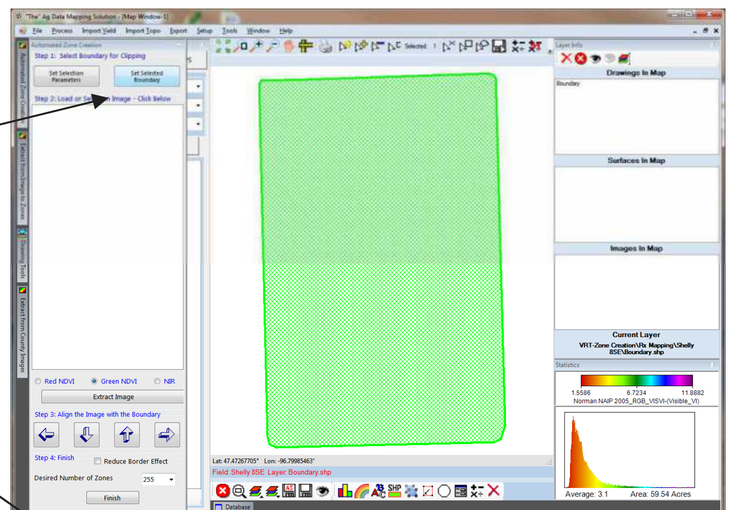
Creating Zones From Imagery

Automated Zone Creation



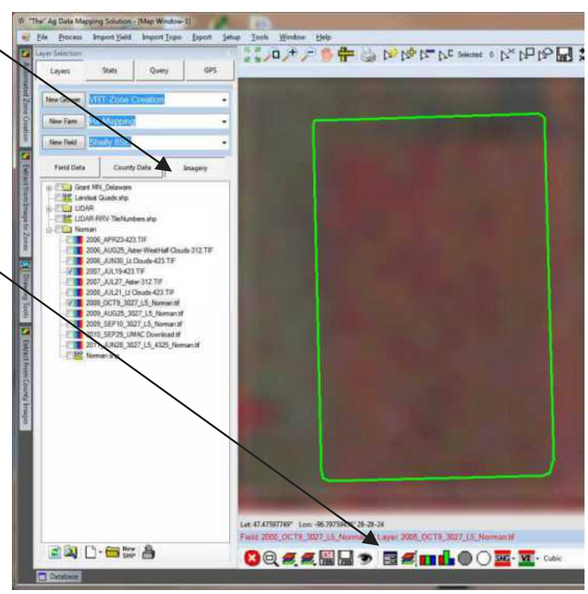
1. Select the desired **"Boundary"**, make sure the bottom Active Layer has the address of this polygon.
2. On the side of the window you will see the **"Automated Zone Creation"** button, click on this button.
3. The Automated Zone window will appear.
4. Under "Step 1", select the following button:

5. Click inside the Boundary. It will appear Lime Green.



6. Go back to the Automated Zone tab and click on:

7. The Boundary will go back to its normal color.
8. Go to the **"Imagery Tab"** and select the image(s) year and month you want to extract.
9. Satellite imagery is not perfectly geo-referenced and is often low resolution (20 to 30 meter pixels). The geo-referencing may be adjusted by going to **"Image Properties"**

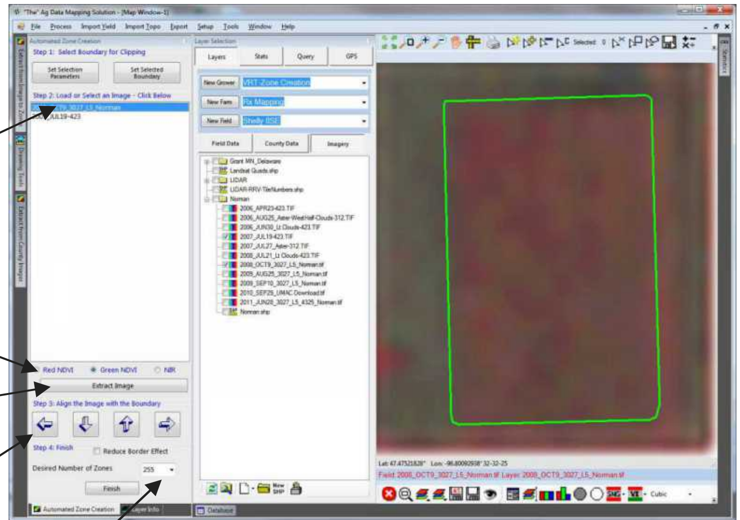


10. A new window will appear which has arrows to update the image position.
11. Once the image is aligned

- Click **"Update Position"**

Creating Zones From Imagery

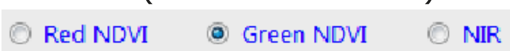
Automated Zone Creation



1. Go back to the "**Automated Zone**" Tab.

2. Click on the image in the "**Load or Select an Image**" area of the "**Automated Zone**" tab

3. Choose "Red NDVI" "Green NDVI" "NIR" (See Notes below)

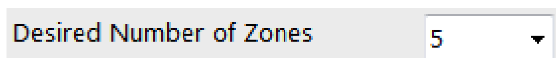


4. Click "**Extract Image**"

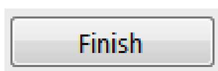
5. Take note of the **"Arrow"** buttons.

   - *Use these to give the field finite placement.*

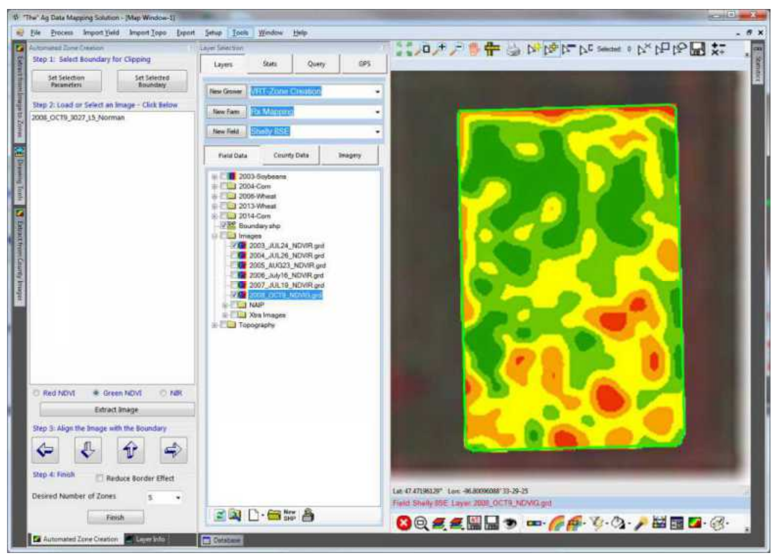
6. Select the "**Desired Number of Zones**" you want to have in your map.



7. Click the **"Finish"** button.



8. Repeat 2-8 on all the images you want to "Extract"



NOTE: On Clicking "**Finish**".

The software cut your image to a "5 Zone" image and created the zones using "K Means".

Image Extraction Suggestions:

***Red NDVI**—Best images with moderate to heavy vegetation*

***Green NDVI**—Best on image with light vegetation*

***NIR**—Best on Bare Soil or no vegetation*

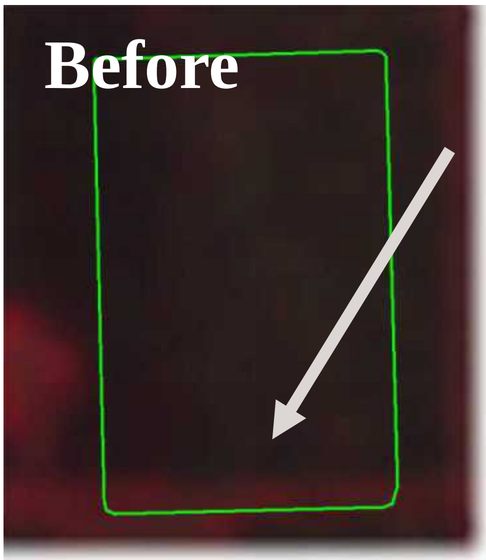
Creating Zones From Imagery—Manual Zone Extraction

Introduction

Images used for zone creation will have multiple bands of data that can be utilized to create management zones for precision applications. With the tools available in ADMS different types of images can be extracted in different ways. This can be extracting individual bands, or by using several vegetative indices. These tools use the native resolution of the image, and default color table.

Geo-referencing an Image

Often images; especially landsat will not be perfectly geo-referenced. To update the position of an image a known reference layer such as a boundary is needed.

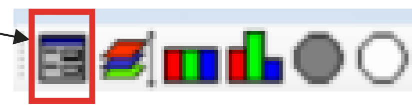


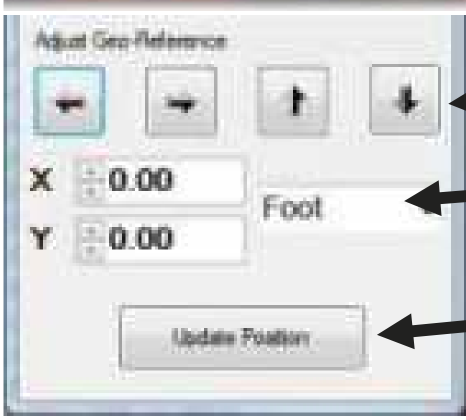
- Turn on the boundary.
- Turn on the image that needs to be aligned (It needs to be the Active Layer in red at the bottom of the Map Window).

Notice the road (light red) is on the wrong side of the field boundary.

The image needs to be the Active Layer.

On the bottom toolbar select the "Image Properties" button.

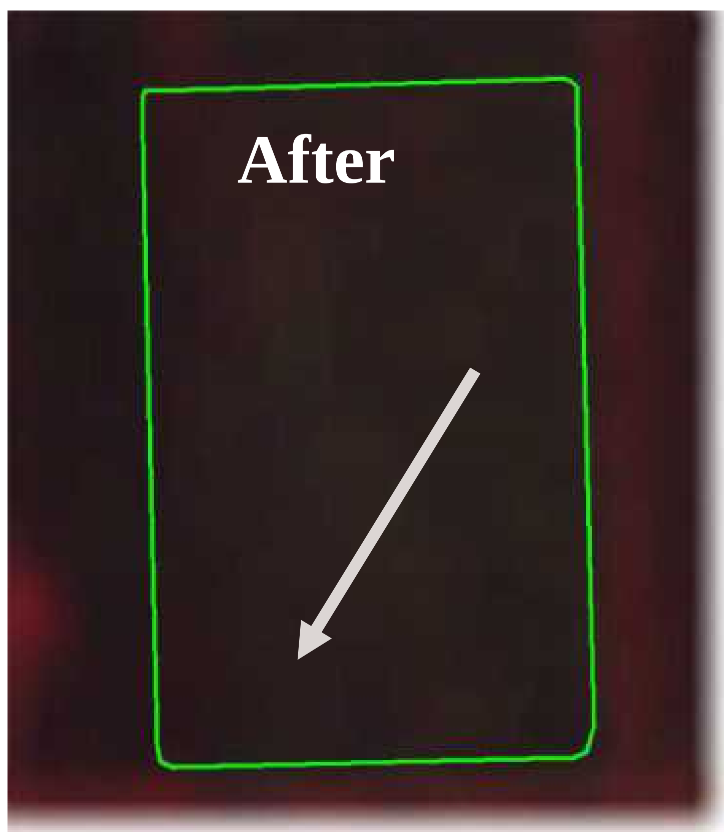




Use the arrows to adjust the image position.

From the dropdown menu different units can be selected. Each click with be equal to one unit. Additionally numbers can be entered manually into the boxes.

Once satisfied with the position of the image click "Update Position."



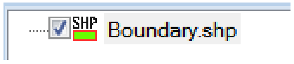
Creating Zones From Imagery—Manual Zone Extraction

4 Band Images

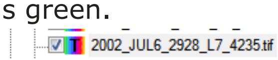
Four band images (Landsat) usually have the Red, Green, Blue, and an Inferred band in the image. The bands can be extracted out individually, or a vegetative index like NDVIR or NDVIG can be used.

Using NDVI

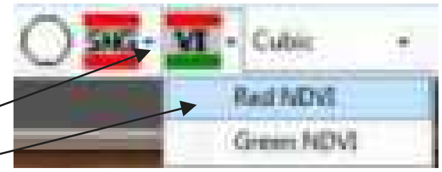
1. Turn on a field boundary.



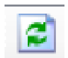
2. Select inside the boundary so it turns green.
3. Turn on the image to be extracted.



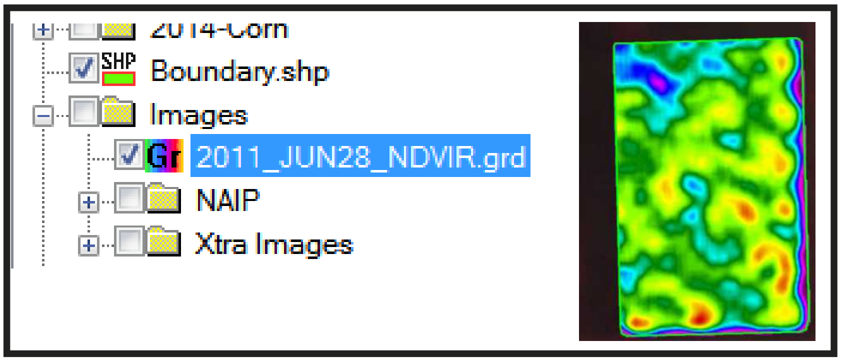
   - *Make sure it is the active layer*
4. On the bottom toolbar select the Vegetative Index icon.
5. Choose either the Red NDVI or Green NDVI option



6. Go to "Field Data."
7. Refresh the data tree.



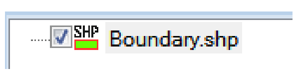
8. The extracted surface will be automatically saved in a folder called "Images."



3 Band Images

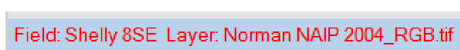
Three band images most commonly have the Red, Green, and Blue (RGB) bands in the image. Each of the bands can be extracted out individually, or the RGB vegetative index (RGB VI) can be used. The visible vegetation index will enhance the vegetation the field.

Using Visible VI

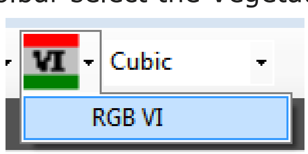


1. Turn on a field boundary.
2. Select inside the boundary so it turns green.

3. Turn on the image to be extracted.

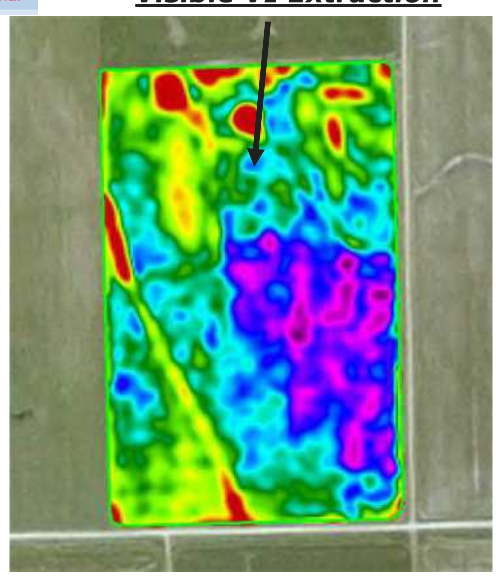


   - *Make sure it is the active layer*
4. On the bottom toolbar select the Vegetative Index icon.
5. Click **"RGB VI"**

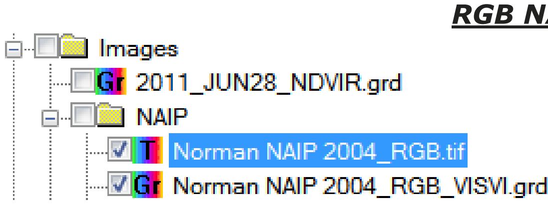


6. The extracted image will be saved in the "Field Data" tab under the folder "Images/NAIP" with the extension **"_VISVI"**

Visible VI Extraction



RGB NAIP Image

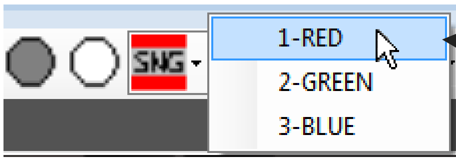


Creating Zones From Imagery—Manual Zone Extraction

Individual Band Extraction

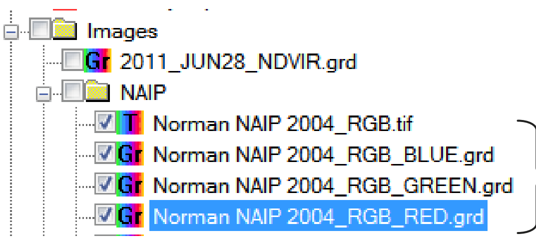
All multi band images can have each band extracted out individually. Commonly, the red, green, blue, and NIR bands will be used. By using the following process each band can be analyzed by itself.

1. Turn on the field boundary and select inside it.
2. Turn on the image to be extracted and make the active layer.
3. On the bottom toolbar select the single band extraction icon.



4. Select the band to extract.

The extracted surface will be saved under "Field Data" in the "Images" folder. The extracted surface will have an extension of the extracted band (_NIR,_GREEN,_RED) that was chosen.

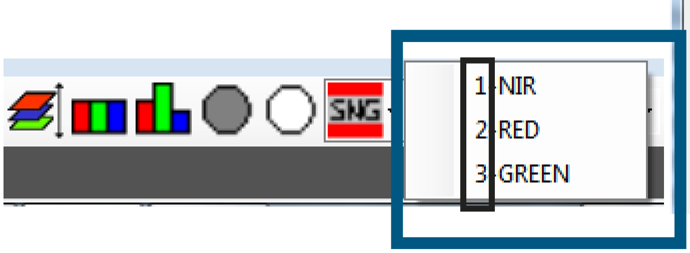


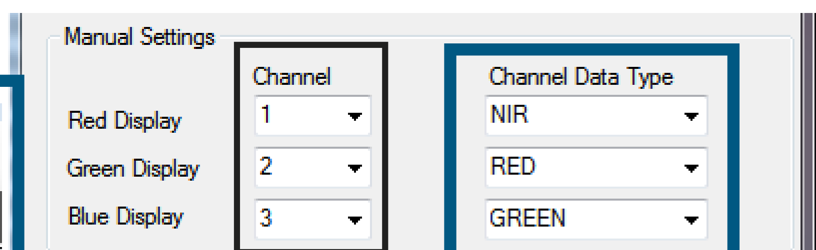
Individual Band Extraction—Changing Band Order

ADMS gives different options to change band orders of images. This can be useful for choosing how the images are extracted and which bands are available for extraction. When the band orders are changed the options in the single band extraction icon on the bottom toolbar dynamically change with it.

To access these options:
1. Make sure the desired image is the active layer.
2. Select the multi-band layer display icon on the bottom toolbar.
3. The "Select Band Order" window will appear.

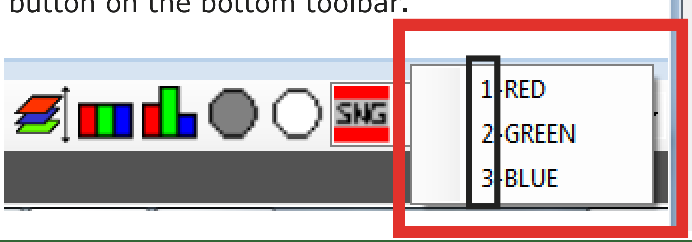
4 Band Image

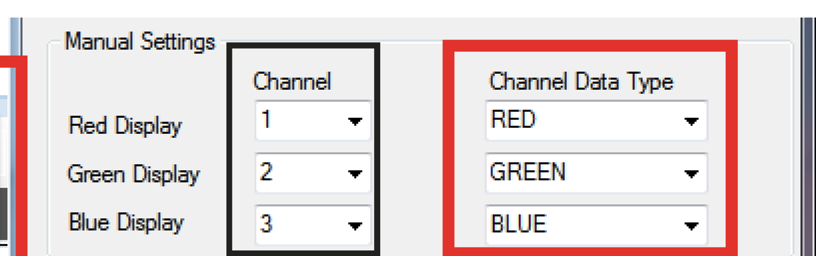




4. The Channel and Channel Data Type will appear the same in the Manual Settings as it does on the SNG extraction button on the bottom toolbar.

3 Band Image





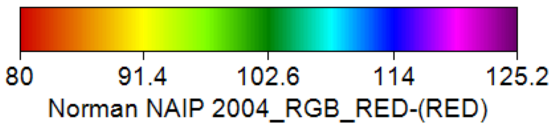
Inverting Surface Values—Manually

At times you will find "Surfaces" that may have values that are inverted from other data sets.

Generally you want to have "Low" values in poor producing areas and "High" values in better producing areas. You can use inverted "Color Tables" to give you an appearance. Inverting the "Values" will allow you to merge this surface with Yield and other images.

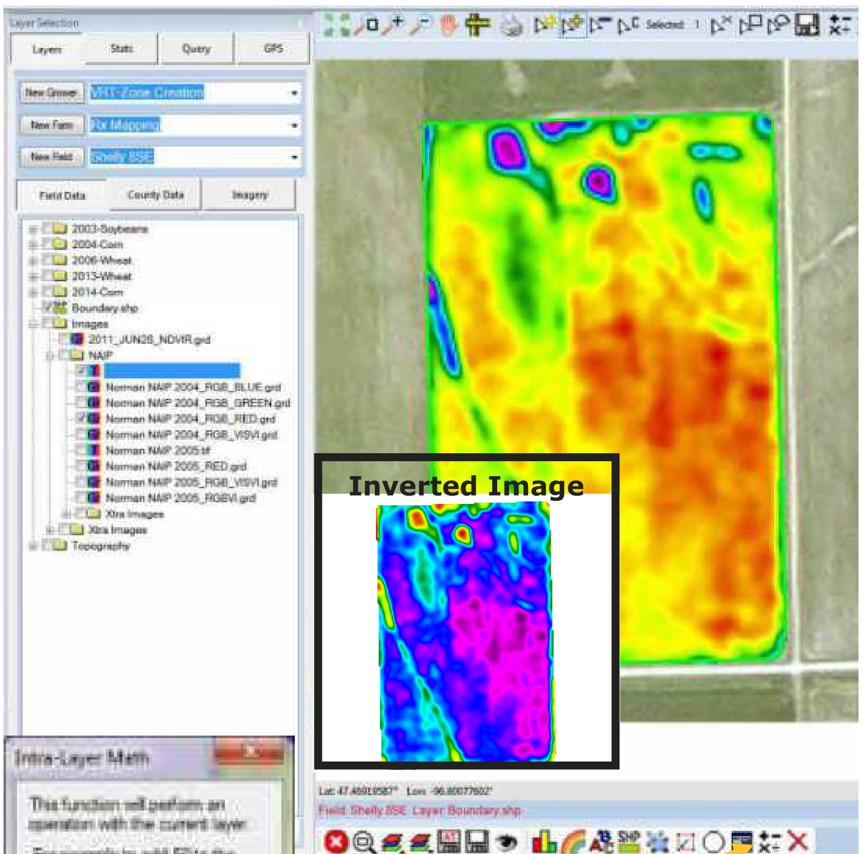
To invert the surface click the "Invert" button and you are done.

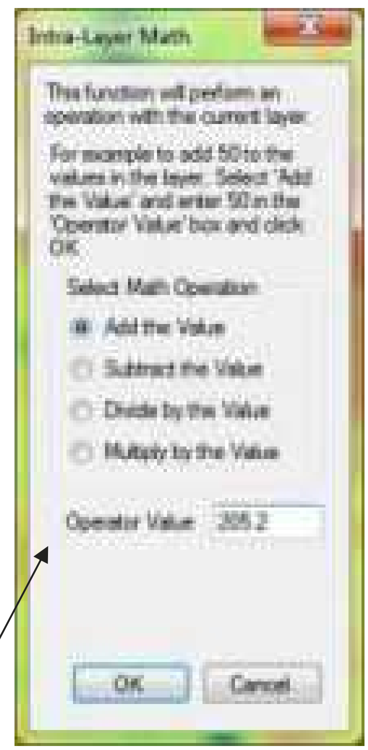
The process of invert Surface values does the following



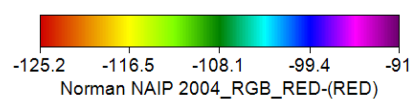
1. Look at your "Color Bar"
2. Add your Min Value + Max Value = New Value

80 + 125.2 = 205.2

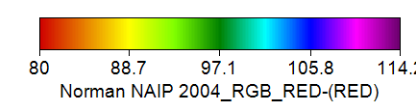




3. Using "Intra Layer Math" button,
   Multiply by a −1
   -Looks "Correct" go to step 4
   -Looks "Incorrect", don't save changes & go to next map or a new map



4. Using "Intra Layer Math" button,
   Add the surface by the "New Value"



5. Select "Save As" and give the new surface a name
   Example—"Norman NAIP 2004 Inverted.grd"

Correlation Matrix

Introduction

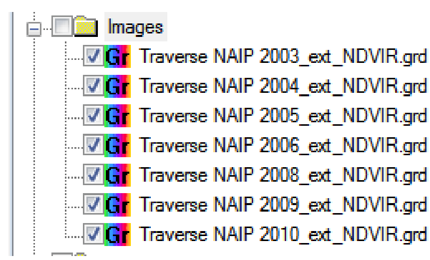
Within ADMS, there is a tool called the Correlation Matrix. This tool is used to measure similarities and differences between multiple layers that are turned on. This tool can be used on any surface including imagery, yield, and prescription maps. It is helpful for measuring the similarities between different images as well as aiding in blending nutrients. The correlation matrix uses the Pearson correlation coefficient and measures the linear correlation between two variables. The output value will be between −1 & +1. The closer the value is to +1 the stronger the correlation.

Correlation Value	Meaning
Less than 0.3	Not Meaningful
0.3—0.5	Weak Correlation
0.5 –0.7	Moderate Correlation
0.7—1.0	Strong Correlation

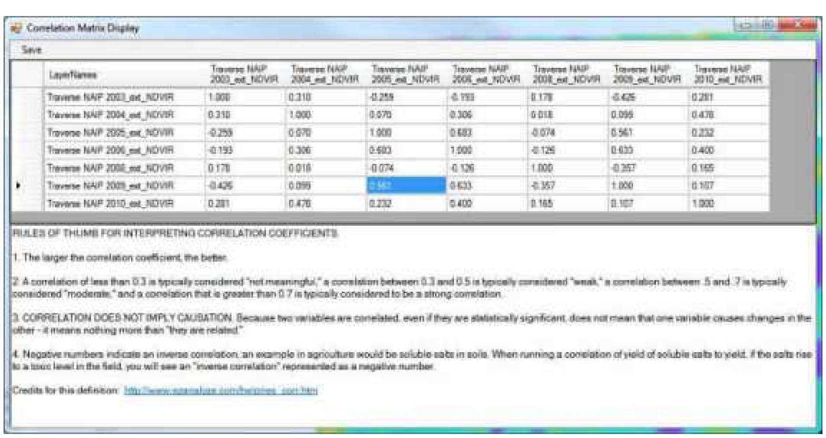
- Correlation does not imply Causation
  - Because two variables are similar or have a strong correlation does not mean that they are related to each other.
- Negative numbers indicate an inverse correlation. An example would be a correlation between yield and soluble salts. If the salts are at a higher or toxic level in the field the yield would be lower. Therefore a negative correlation would result.

Using the Correlation Matrix

1. Clear the Map Window so no layers are turned on.  Even if the layers are not visible but still turned on, the correlation matrix will run on all of them. The more layers that are turned on, the longer it will take to calculate.
2. Turn the layers on that the correlation matrix will be calculated on.



3. On the bottom toolbar, select "Calculate Correlation Matrix."



4. The utility will run and display a window with a table in it showing the correlation values.

   - If desired, this table can be saved as a *.CSV file by clicking Save in the top left corner.

Correlation Matrix—Explained

This example was done on 3 years of corn yield and an image from each year.

- The yield maps are 2008, 2009, and 2010
- The image maps are NDVIR from July in 2008, 2009, and June in 2010.
- This table can be read top to bottom, or left to right.
- From the values it can be seen that the same map correlates perfectly with itself each time.

LayerNames	Corn Yield 2008	Corn Yield 2009	Corn Yield 2010	2008_JUL14_NDVIR	2009_JUL01_NDVIR	2010_JUN18_NDVIR
Corn Yield 2008	1	0.107	0.607	0.641	0.262	0.383
Corn Yield 2009	0.116	1	0.225	0.061	0.324	0.089
Corn Yield 2010	0.614	0.214	1	0.71	0.396	0.685
2008_JUL14_NDVIR	0.636	0.06	0.706	1	0.457	0.591
2009_JUL01_NDVIR	0.264	0.319	0.398	0.457	1	0.279
2010_JUN18_NDVIR	0.376	0.09	0.682	0.591	0.279	1

Correlation Value	Meaning
Less than 0.3	Not Meaningful
0.3—0.5	Weak Correlation
0.5 –0.7	Moderate Correlation
0.7—1.0	Strong Correlation
1	Perfect Correlation

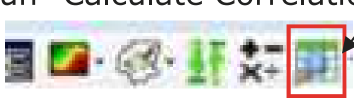
- Now this tool can be used as part of the image selection process when choosing NDVI images to use in zone creation.
- Looking on the table, it can be seen that Corn Yield 2010 and 2010_JUN18_NDVIR have a 0.685 correlation value meaning it is MODERATE. This would be an image that could be considered for a final zone map.

- Other similarities can be seen. Such as how similar yield maps are from one year to the other.

Using the Correlation Matrix for Determining Blends

The correlation matrix can also be used for determining which products could potentially go together in a product blend. An example of this would be if multiple products had to be spread, but only a single bin spreader was going to be used for the application.

1. Turn on all the product application maps.
2. Run "Calculate Correlation Matrix."



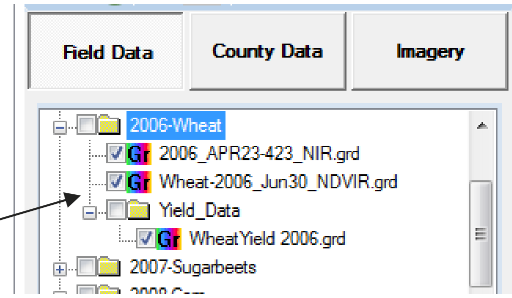
LayerNames	0-0-60	11-52-0	46-0-0
0-0-60	1	-0.017	**0.88**
11-52-0	-0.017	1	-0.489
46-0-0	**0.88**	-0.489	1

3. From the results, it can be seen which products spatially correlate with each other.

- This example uses 0-0-60, 11-52-0, and 46-0-0. The resulting table shows a strong correlation between the
- 0-0-60 application map and the 46-0-0 application map. This would be an indicator that these two products could fit well if blended together.
- Likewise, there is a negative correlation between 11-52-0 and 46-0-0 & 11-52-0 and 0-0-60
  - These products should not go together in a blend.

Creating Zones From Imagery

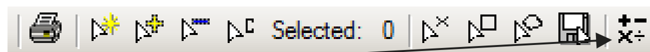
Average of All Layers Script (Images / Yield / Topo / Veris)



If multiple .grd files exist for one "Field", these surfaces can be merged to combine traits.

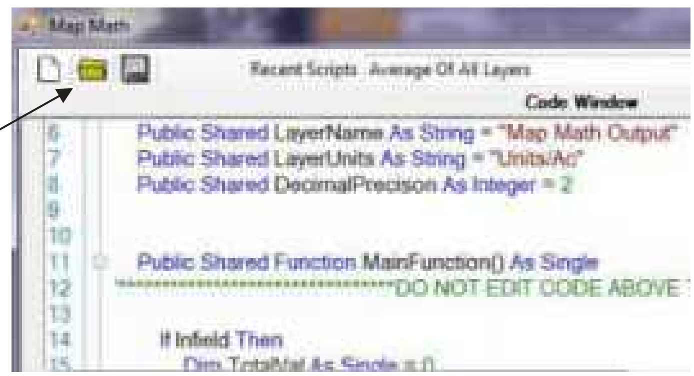
1. Click **"Layer Info"** and "**CLEAR MAP**" 

2. Turn on JUST THE .grd maps you want to "Merge" (2—200 surface rasters from Imagery / Yield / Topo / Veris)



3. Now, click the "**Multi Layer Map Math"** button located in the top map toolbar.

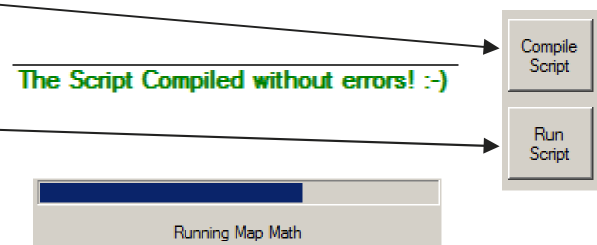
4. The **"Map Math"** window opens.



5. Click the "Open Existing Scripts" Button.

6. Find the **"Average Of All Layers.txt"** file and click open.

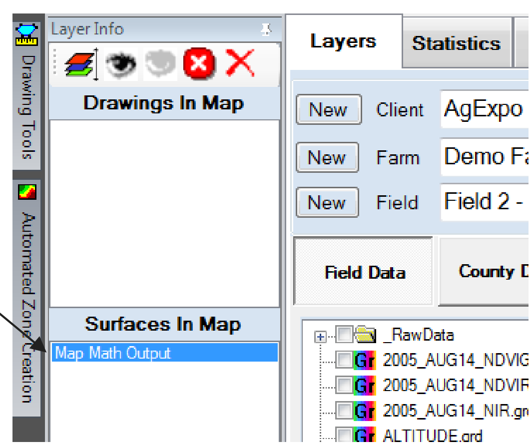
7. Note the "Code Window" should populate with some data looking like this.



8. Click **"Compile Script"**.
   (If all is correct you should see this)

9. Click **"Run Script"**.

10. Close the "**Map Math"** window.



11. Go to the "Layer Info" tab on the left side of the screen

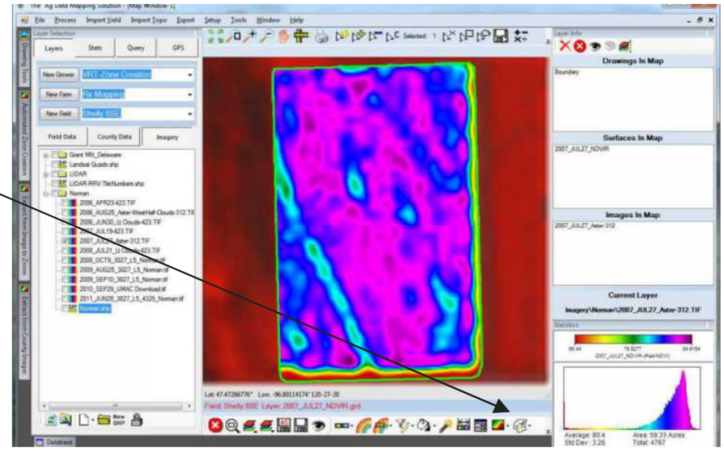
12. Select the "Map Math Output" from the "Surfaces In Map" list

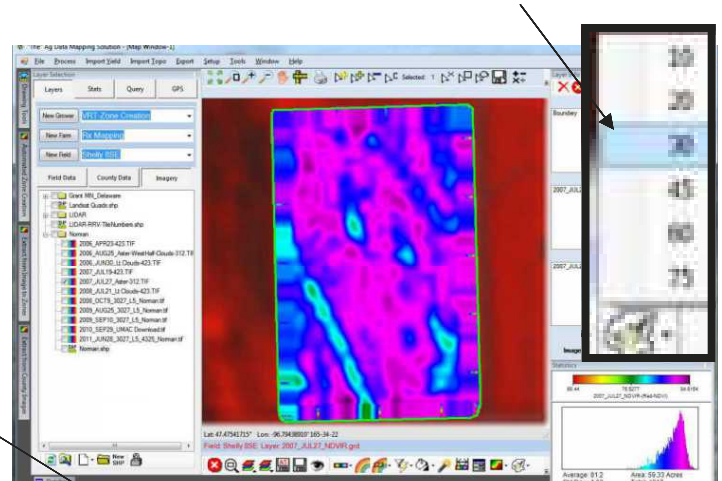
13. Click on the "Save As"  button on the bottom toolbar and call this "3 surface merged.grd" (or whatever name represents the new object created).

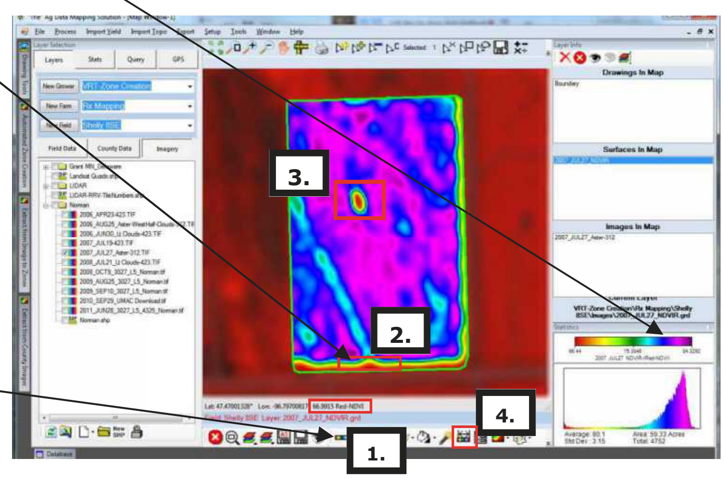
* *More detailed information on Map Math Controls under the Advanced Scripting section .*

Creating Zones From Imagery

Coloring and Prepping - Surfaces



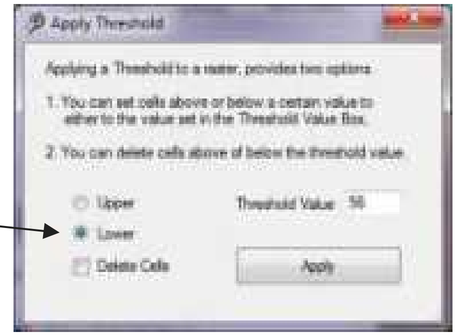




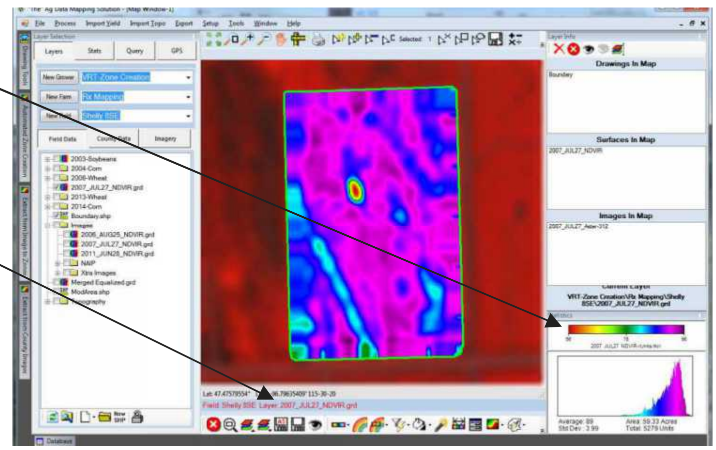
1. You will notice there is a very distinctive Red Border along the south side of the field. This is not representative of the field. This is called a Border Effect. There is a tool **"Reduce Border Effect"** that will help clean up these edges. Knowledge of the field is the factor that will tell you if you need to use this tool or not.
2. This field has some obvious "Border Effects" so, select the **"Reduce Border Effect"** button. Take note this will not work if the Boundary is not selected.
3. Once you click on the **"Reduce Border Effect"** button, the software will reach in x-meters perpendicular to the Border and pull that value out to the border.
4. Once the new colored image shows up, move your mouse over the image. You will notice there is a number at the bottom center of the screen (labeled #1) that is changing as you move the mouse. That value is the pixel value of that location on the map (note the "Color Bar" on the right side of the screen). The higher the value of the pixel, the greater the vegetation.
5. You will notice the box around the area labeled #2. That little bit of red on the edge is most likely bleeding of non-crop influence from the original satellite image. The pixel values in this area are 43 to 50 in this red area.
6. Looking at the area labeled #3. Moving your cursor around over this area, we find out the lowest values in the reddish area is 56. These are all "Actual" or true field values.
7. Once you have inspected the image, you must decide if there is anything that needs to be cleaned up or "Trimmed". On this image, it is fairly clear that this value does not represent what is happening in the field. So we are going to "Trim" the image. On the bottom tool bar click on the **"Trim End Values"** button (labeled #4).

Creating Zones From Imagery

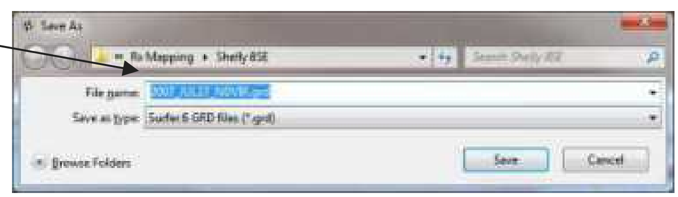
Coloring and Prepping - Surfaces



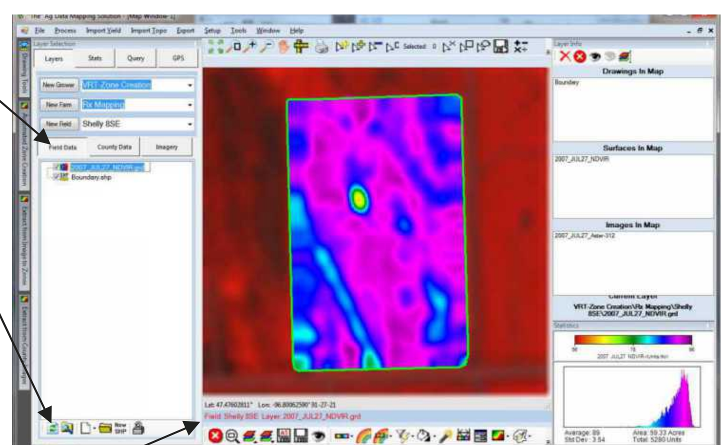
8. The "**Apply Threshold**" window will open. For doing Imagery, you will want to select "Lower" check box. Make sure the "Delete Cells" is **<u>not</u>** selected. Inspecting the image in the prior few steps, we found that 56 was the lowest "real" value in the field. So type in 56 in the "Threshold Value" box, and click **"Apply".**



9. You will notice that our **"Color Bar"** on the right side of the screen now reads from 56 to 96, confirming that the "Trimming" did work.
10. Looking at the image that has been created, you will notice the image looks a little rough. Use the **"Smoothing Filters"** button by selecting the drop down on the right side. In most cases, the "5x5 Low Pass" will smooth out the rough edges.
11. Select **"Save Changes"** button on the lower tool bar.
12. The **"Save As"** window will open up. Make sure the file is being saved into the correct folder under the GKData folder (this should be the same location as the field boundary, if you created one).



13. Make sure that in the **"File name:"** box you use the Image date as part of the name of the file. This is the only way to identify the year and date of the image. When finished, click on the **"Save"** button.
14. Now you will be back to the Ag Data Mapping Solution window. You will want to direct yourself to the **"Field Data"** tab on the left side of the window and make sure you are set to the proper "Grower", "Farm" and "Field". You may have to click on the **"Refresh Tree"** button on the bottom of this window.
15. You may notice that your new field image (**.grd) is not showing up in the Active Layer below the viewing window. If not, select the field from under the "Field Data" tab by simply clicking on the file name one time.

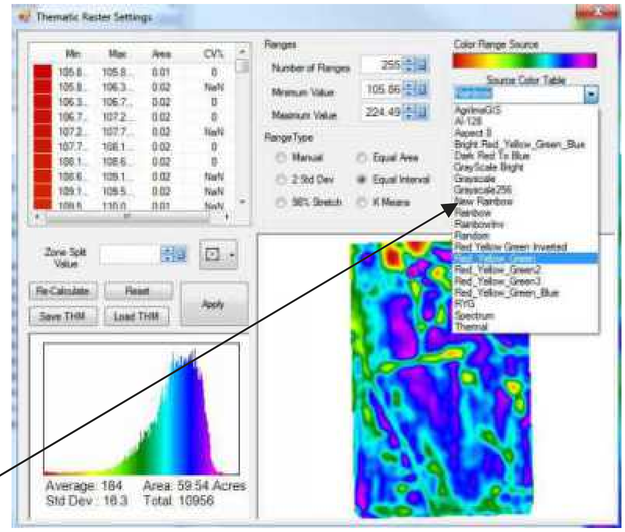


Field: Shelly 8SE Layer: 2007_JUL27_NDVIR.grd

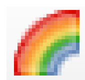
Creating Zones From Imagery

Manual Zone Creation

1. In the zoning process, the values of the image do NOT change (unless you change end values). We are just changing the colors associated with the values. These colors are used to isolate areas of the field that perform differently.

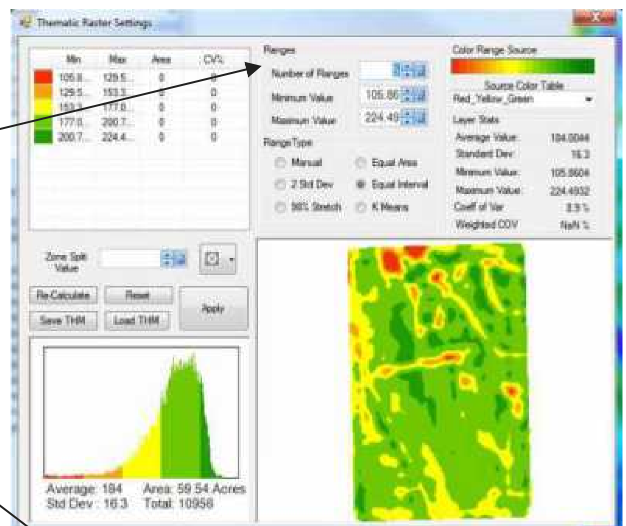


2. Select the **"Thematic Color"** button of the lower toolbar.



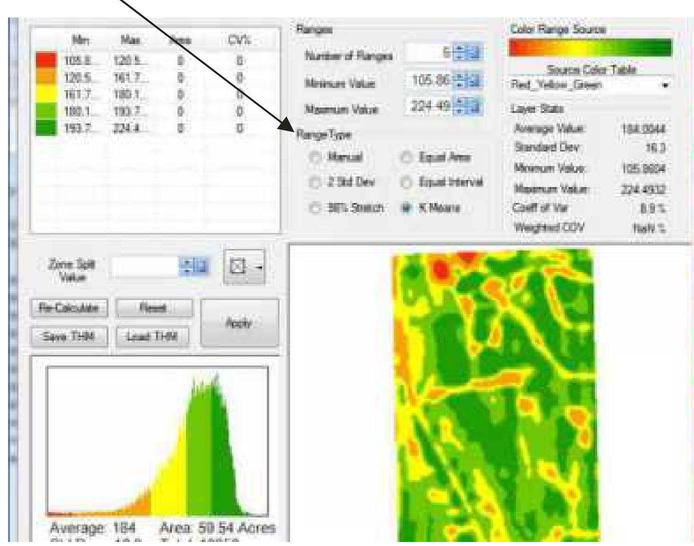
3. The "**Create 'Color By Value' Table"** window will open up.

4. Select the **"Source Color Table"** you want to use and leave the setting on "Automatic".



6. Adjust the number of zones by changing the value in the **"Number of Ranges"**. If you are creating sample zones in your field, it is important to keep in mind the number of samples you want to pull.

5. Next, select the **"Range Type"** you want to use. These are mathematical ranges based on the inputs and number of ranges selected. Typically for satellite imagery, you will want to use "2 Std Dev" or "K Means".

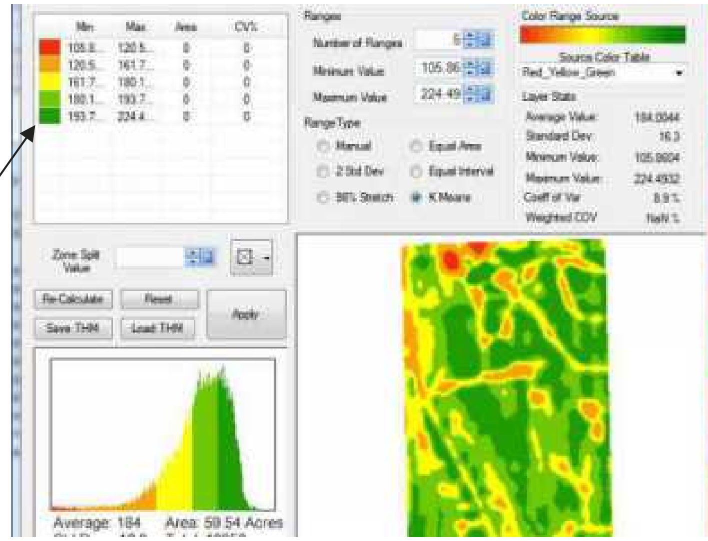


Creating Zones From Imagery

Manual Zone Creation

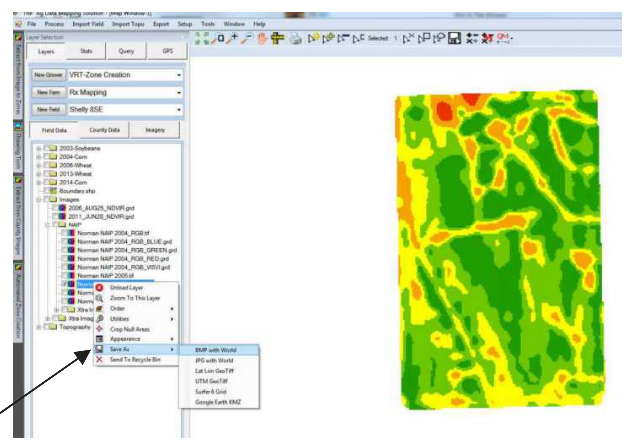
6. The statistical methods may not give you the exact zones you are looking for. You may want to adjust the zones manually.

7. To manually adjust a zone, place your mouse over a color chip and "Scroll" your mouse wheel. This will adjust the "Lower" value of the range.



8. Repeat this process to adjust all the zones you want to change. Note: adjusting the highest value does nothing, you are moving the top value of the color chip.

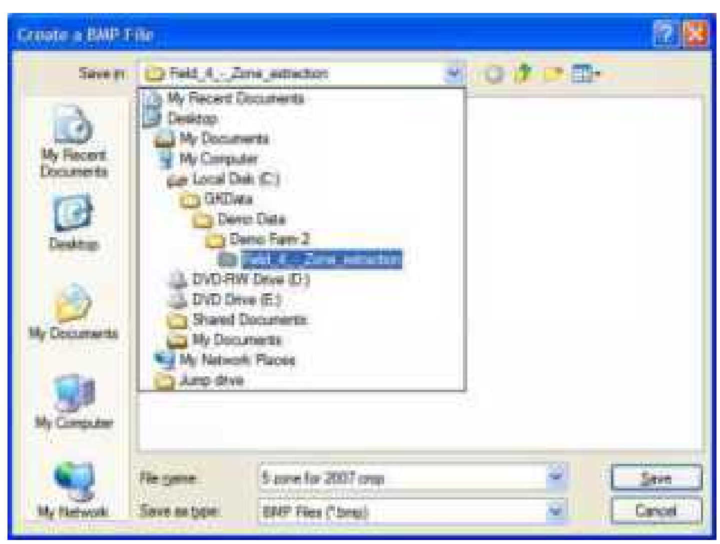
9. If the map in the preview window is acceptable, click on the **"Apply"** button. This will automatically save these settings to the desired image.



10. If you are going to be using Ag Data Mapping Solution to find the zones for sampling, you are done. If you are using a PDA or exporting to another program, you will want to save this image in another format.

11. To save this image in a new format, "Right Click" on the file name you want to save, select "Save As".

12. For GK Technology's PDA software, Pocket Field Recs, export the file as a BMP.



13. When the **"Create a BMP File"** window opens, save the file in a location where you can easily access it for transfer. We suggest using the "Field Name" as part of this "File name:"

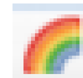
14. You are now finished with manual zone creation.

Creating Zones From Imagery

Thematic Raster Settings

The "Thematic Raster Settings" change how raster surfaces are displayed. This window will now allow any of the values in the map to be changed. Instead it changes colors and how they are represented.

To access these settings click on the "Thematic Color" icon on the bottom toolbar.

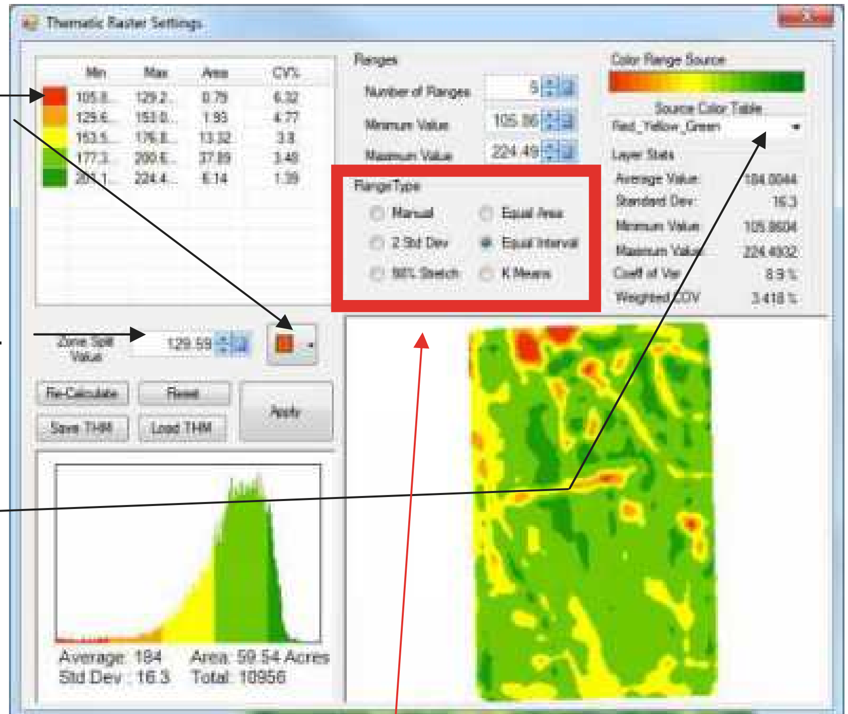


This will open the "Thematic Raster Settings" window.

Color Chips—These can be changed or modified individually to add custom colors to the map. Each color chip as a min, max, area, and coefficient of variation value.

The split values can be adjusted by scrolling over it with the mouse wheel or manually adjusting the zone split value. This will only adjust the Max value.

Color Tables—Different color tables can be applied to the map.



Range Types—Allow for automatic statistical grouping of the colors by values on the map.

- K Means—Recommended for imagery and zone creation.
  - ⇒ Clusters the data in a way so each zone has the lowest coefficient of variation possible. This minimizes the variation between data groups.
- 2 Std Dev—Recommended for imagery and zone creation.
  - ⇒ Multiplies the Standard Deviation by 2. Then it adds and subtracts that value from the mean. These are the new high and low values.
- 98% Stretch—Recommended for imagery and zone creation.
  - ⇒ 1% of the values are taken from the top and 1% of the values are taken from the bottom end.
- Equal Interval—Recommended for topography or prescriptions when creating contour polygons.
  - ⇒ Makes each color have an equal range of values.
- Equal Area—Not commonly used.
  - ⇒ Each zone has equal area

Creating Fertilizer Products

Before getting started with writing Prescription maps it is suggested that you confirm that you have all the “Products” you would want to use.

1. On the top toolbar, select **“Setup”** and **“Fertilizers”.**

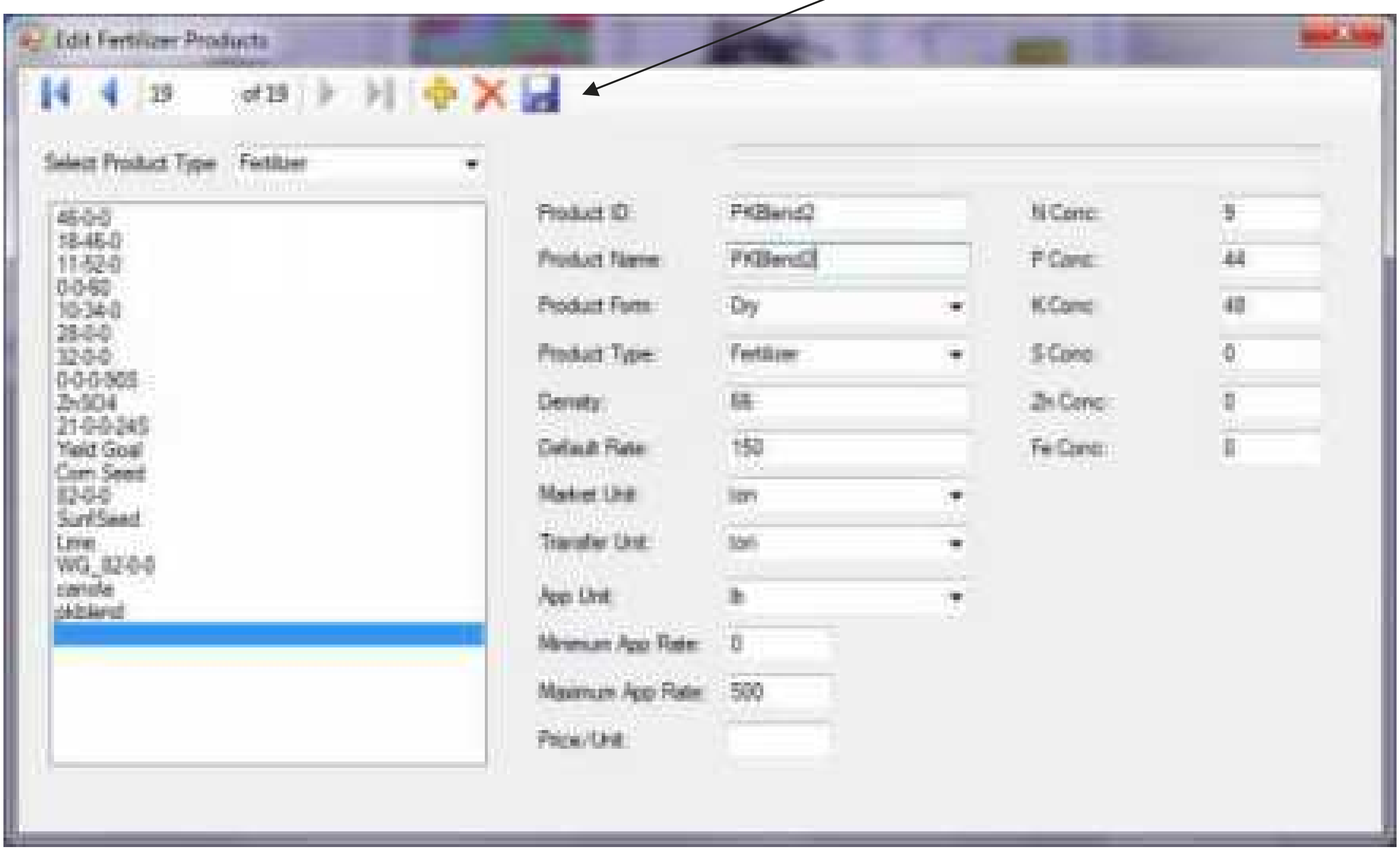
2. At the **“Edit Fertilizer Products”** window, select **“Add New”.**

3. Enter all the values for the product (custom PK)
   Keep names less than 12 characters
   “N Conc” is the % by weight analysis
   If you enter all the “Conc” values on the right,
   the product will be available for “Blend Groups”
   Seed products do not enter “Conc” values

4. When finished, select **“Save”.**

5. Create as many Fertilizer Products as needed by starting at step # 1

6. When finished “Close” this window



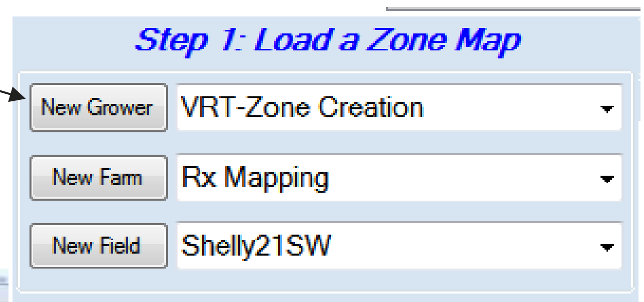
Nutrient Layers

Creating Prescription Maps

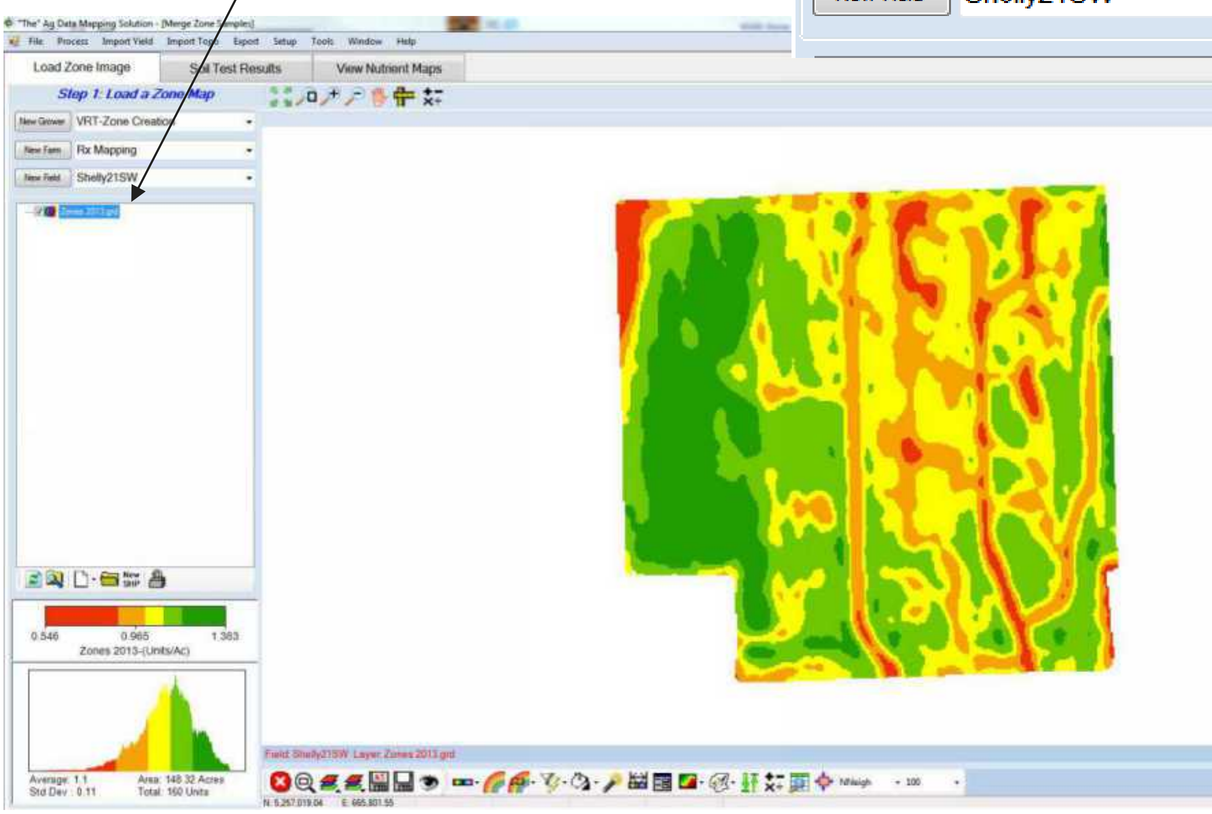
For this section, we will be combining your soil test / application rates to your zone map for the purpose of creating an application map for single or multiple products. It is your responsibility to understand the output maps and what the values on the maps mean.

1. Start up Ag Data Mapping Solution and Select the **"Merge Zone Results"** Icon, or go to the top tool bar and select the **"Process"** button and **"Merge Zone Results".**

2. Select the Correct "Grower", "Farm" and "Field" where you created the zone maps.



3. Select the **"Zone Map"** you will be using for this field.



Use one of the following sections:
"CSV Soil Test Results"
"Creating Prescription Maps—Manually"
"Using Blend Groups"

Nutrient Layers

Creating Prescription Maps—Manually

1. Next, select the **"Soil Test Results"** tab on the top of your Nutrient Layers window.

2. Enter soil test results from a printed soil test or just click **"Enter Result Manual-ly".**

3. From the **"Select Products"** window, select which products you will be using for the application. One or more products may be selected.

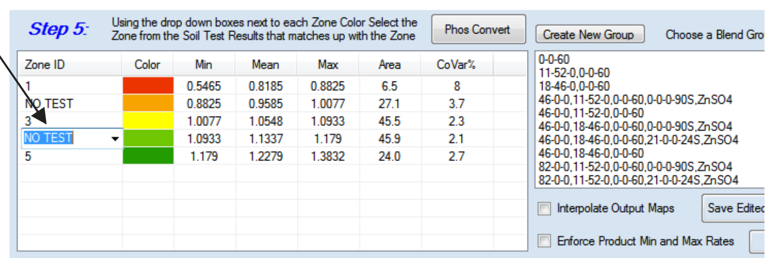
4. If you do not see the product you would like to use, Cancel and go to the **"Creating Fertilizer Products"** section of the guide.

5. The "Zone_ID" is already selected as **"Column that contains the Zone ID".**

Soil TestResults

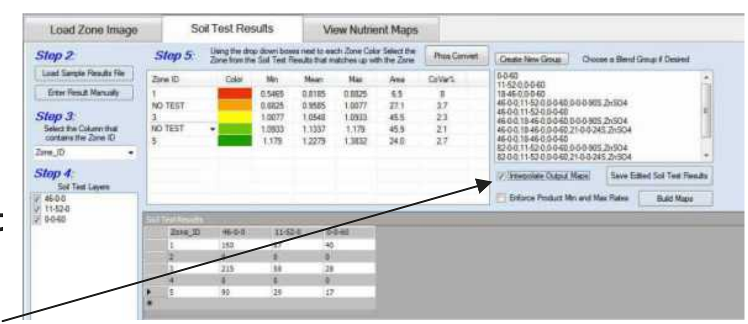
Zone_ID	46-0-0	11-52-0	0-0-60
1	160	87	40
2	0	0	0
3	215	58	28
4	0	0	0
5	90	29	17

6. Select the Test Result to be associated with the appropriate color from the Zone map. **If there is no test for a color in the map you must select "No Test" next to that color.**



7. Now enter the product totals from the soil test results to their appropriate Zone ID and Product. **These values are the actual units of product that will be applied by the controller (100 lbs N should be entered as 217 for Urea (46-0-0)).**

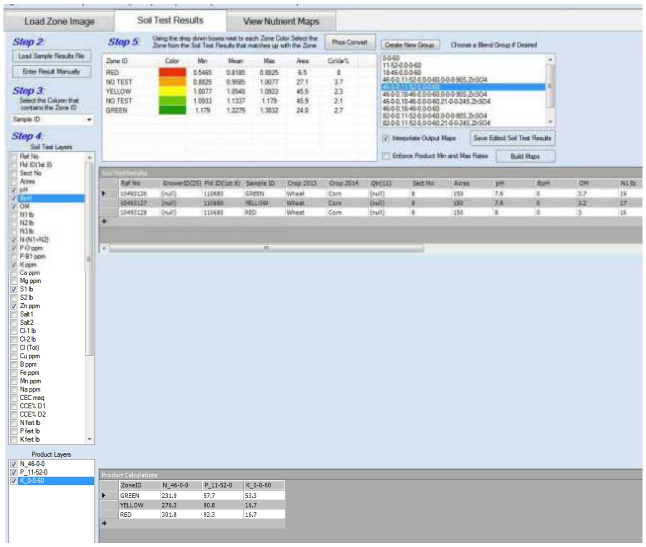
   You can use values as LBS of Nutrient and convert later using steps 10 -13, or change the values in the **"Soil Test Results"** table.



8. With all these items selected and values filled in, check **"Interpolate Output Maps"** and click **"Build Maps".** (By NOT checking the "Interpolate" box you will get a 5 rate zone application map "consider" for seeding maps).

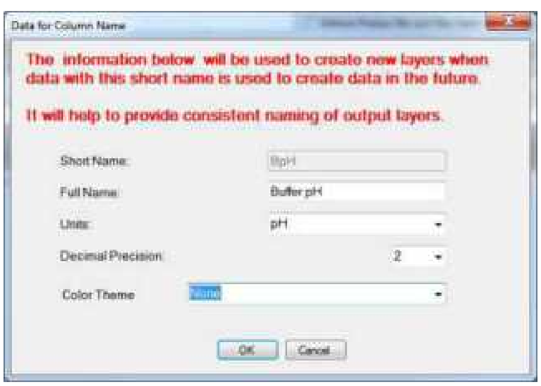
Nutrient Layers

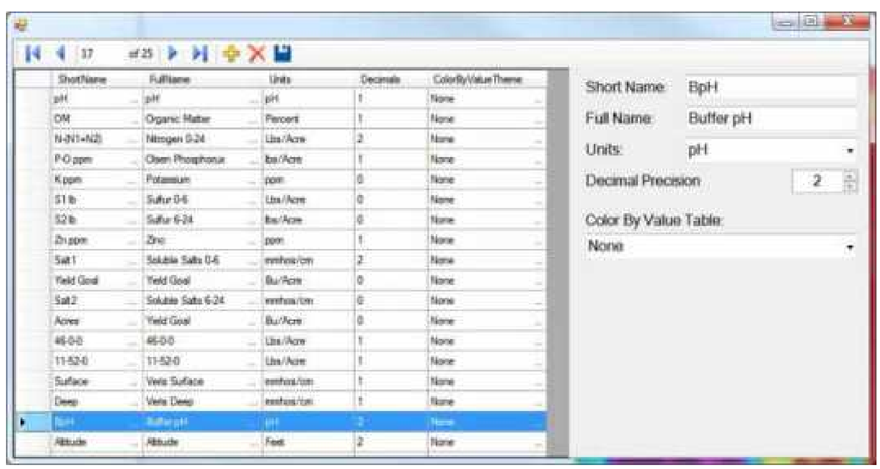
Common Name Mapping Database

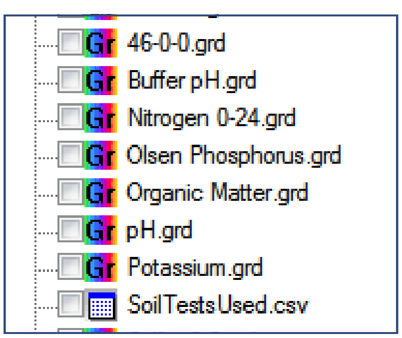


Above you see a standard Zone Nutrient mapping box.

1. When building a map for a Soil Test Layer or Product the first time, it will ask for information about that column (Fill in all the blanks).
2. This information is stored in a database and used to create the maps from that column from then on. This is the name it will always use.
3. For example a column named BpH in an Agvise Export, if used to create a layer, will create a layer named "Buffer pH" and the units will be set to pH, and set to display 2 decimal points.
4. To Edit the names. Go to the Top Toolbar, Setup, Common Name Mapping.



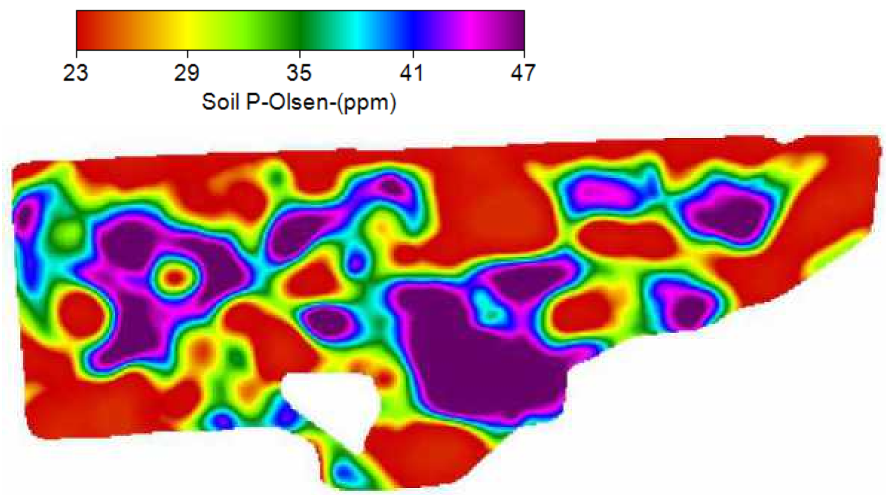




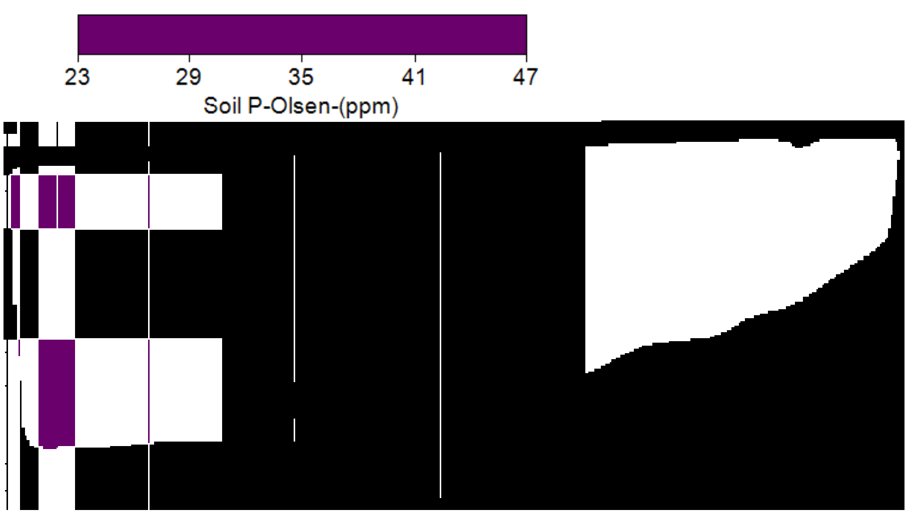
Nutrient Layers

Color Layers By Theme

In ADMS there are some tools that allow raster layers to be colored by certain values or color themes. The benefit of having color themes is that it gives visual consistency when looking at certain types of maps such as nutrient layers. Traditionally when a map gets created a color table gets applied which ranges from the low end color to the high end color despite the values. For example a rainbow color table would always have all the colors no matter what the values are. When dealing with nutrient maps you may want certain colors to always represent certain values. For example red will equal low nutrient levels while purple will equal adequate or excess nutrient levels.
See the phosphorous Olsen map below as an example.



By looking at the map by itself it would appear that a majority of the area is lacking in phosphorous. However, after looing at the color bar it is clear that the Phosphorus values are adequate for this field.



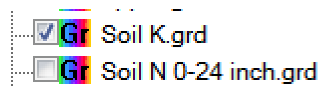
A color theme is applied to this map that tells the software any values 3 or below are bad (red) and 20 and above are good (purple) it is easy to visually see that the Soil P Olsen values are adequate in this field since it is all purple.

Nutrient Layers

Color Layers By Theme

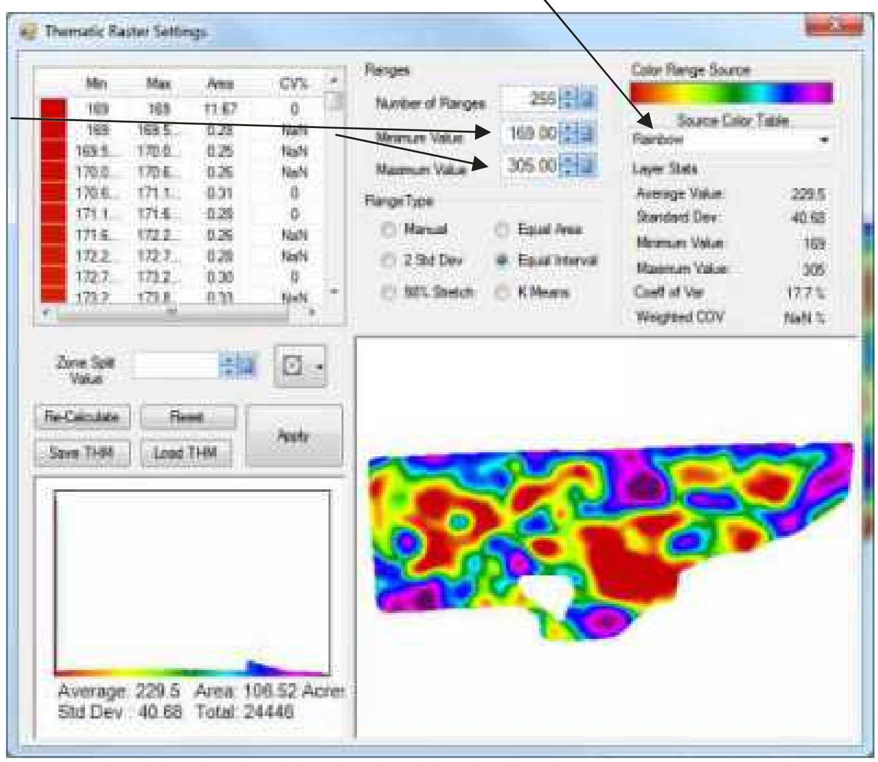
Creating Color Themes

Before color themes can be used they first must be created. In order to create color themes to be used in ADMS you'll need a map to use as a template. For the following examples nutrient maps will be used.



1. Turn on the map that will be used for a template.
2. Open the Thematic Coloring on the bottom toolbar.

3. Once the "Thematic Raster Settings" window is open choose the color table that will be used as the base for the color theme from the "Source Color Table" dropdown menu.



4. Next look at the Minimum and Maximum Values. They will by default be the Min and Max values that exist on the map. To set the range for the color theme these values can be manually adjusted to skew the color table in one director or another.

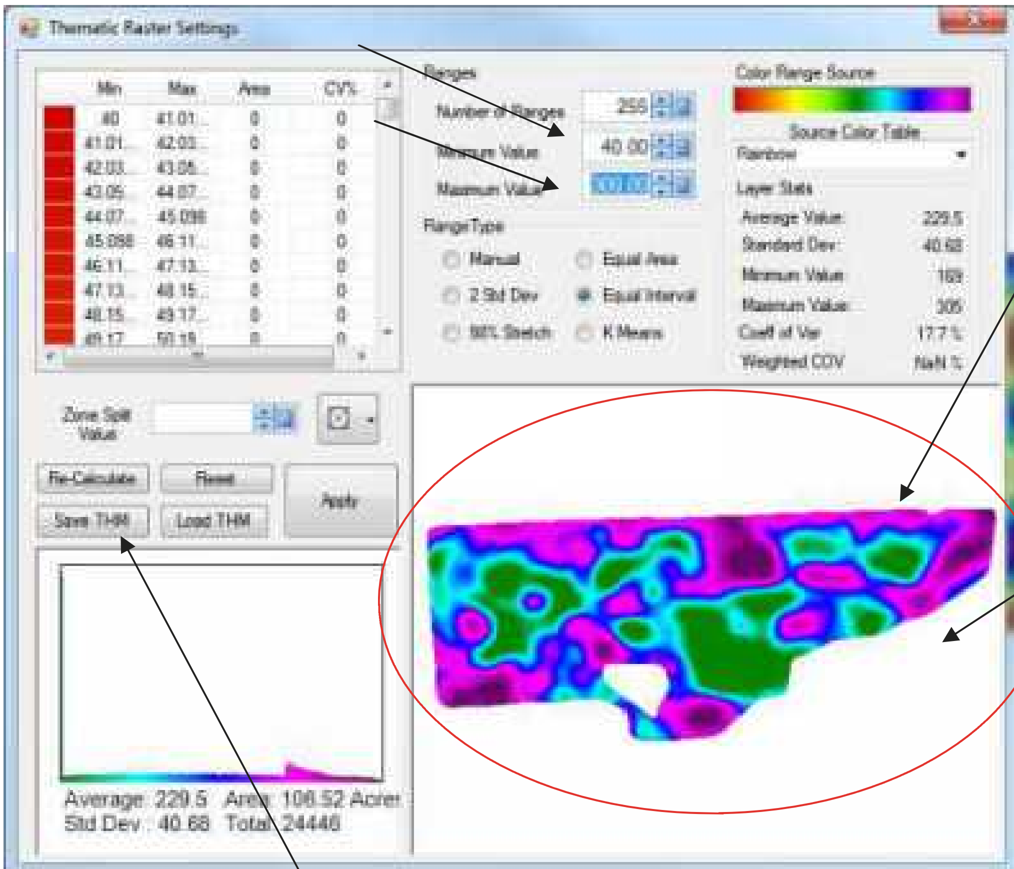
This example will use Soil K. We will say that anything 40 ppm or below will be lacking in nutrients and represented by the low end of the color table (Red). Likewise, anything 300 ppm or above will be represented by the high end value of the color table (Purple). Any values between 40-300 ppm will be scaled accordingly.

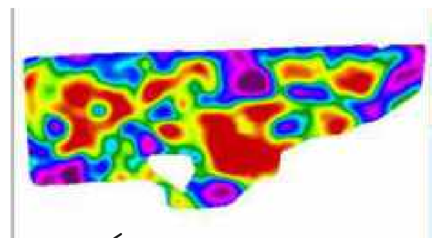
Nutrients	Low Val	High Val
P-Olsen	3	20
P-Bray	3	35
Nitrogen	1	150
Sulfur	5	80
Potassium	40	300
Zinc	0.2	2
pH	5	8
CEC	7	40
OM	1	6

Here are some common value ranges to consider using for different nutrients.

Color Layers By Theme

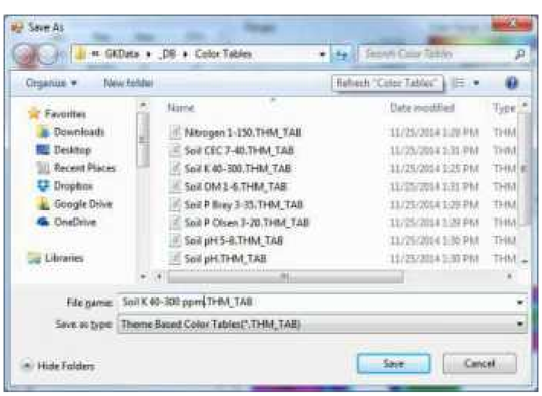
5. In the area that says “Minimum Value” enter “40” and in the area that says “Maximum Value” enter “300.”
6. In the preview window the color adjustments to the map will be visible. Since there is no values below 40 ppm there is no red in the map.





7. After the top and bottom end values are sent properly the theme will need to be saved. Click “Save THM.” 

8. Give the color table a name. We recommend including the value range used to have it for future reference. This will be stored in the _DB\Color Tables folder.



An example of name would be “Soil K 40-300 ppm.” That way if there were multiple Soil K themes it will be easy to distinguish the differences. Since some nutrients may be reported with different units it is also a good idea to include them in the name.

9. Click “Save.” Close out of the “Thematic Raster Settings” window. The color theme is now saved and can be applied to other maps. Repeat this process for additional nutrients.

Nutrient Layers

Color Layers By Theme

Applying Color Themes

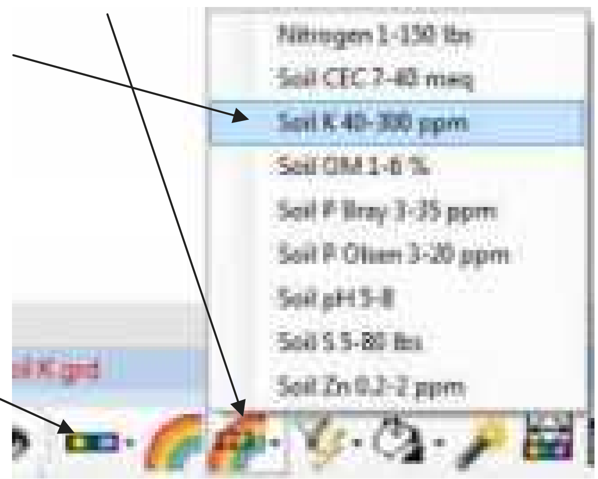
Color themes can be applied easily two different ways. By using the “Load Fixed Thematic Table” button on the bottom toolbar, or through the common name mapping database when nutrient layers are created.

1) Load Fixed Thematic Table—Bottom Toolbar

To load a fixed color theme on any raster the button on the bottom toolbar can be used.

1. Make sure the desired map is the active layer (in red on the bottom of the map window).

2. Click the “Load Fixed Thematic Table” button. This will bring up a list of all the color themes that are currently saved.
3. Click on the theme you want applied to the active layer.
4. The theme will be applied.
5. To go back to the original color table use the “Change Color Theme” icon on the bottom toolbar and choose the original color table.



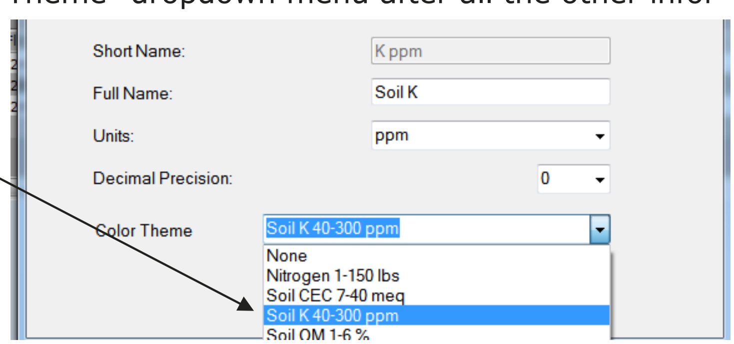
2) Load Fixed Thematic Table—Common Name Mapping Database

Color themes in the “Common Name Mapping” database will only get applied to layers created in the Merge Zone Results or Merge Grid Results windows.

When new layers are created off of a column heading that has not been used before the “Data For Column Name” window will appear. The entries in this window will get applied to the “Common Name Mapping” database and get applied to every layer created from that same column name.

To set a color theme Choose it from the “Color Theme” dropdown menu after all the other information has been entered.

These color themes can be changed in the future by editing the “Common Name Mapping” database.

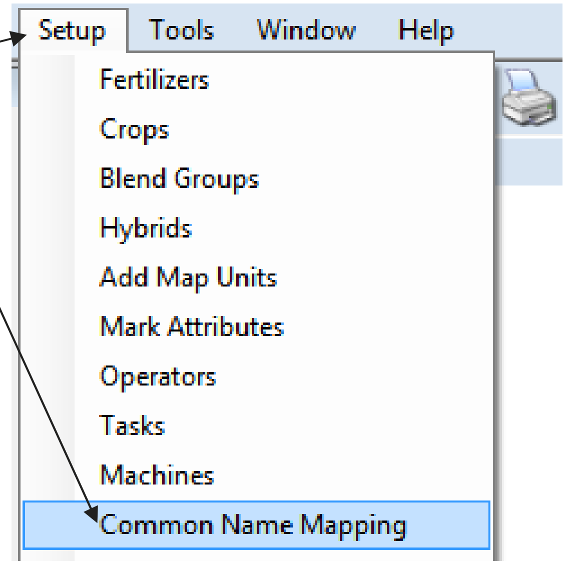


Nutrient Layers

Color Layers By Theme

2) Load Fixed Thematic Table—Editing The Common Name Mapping Database

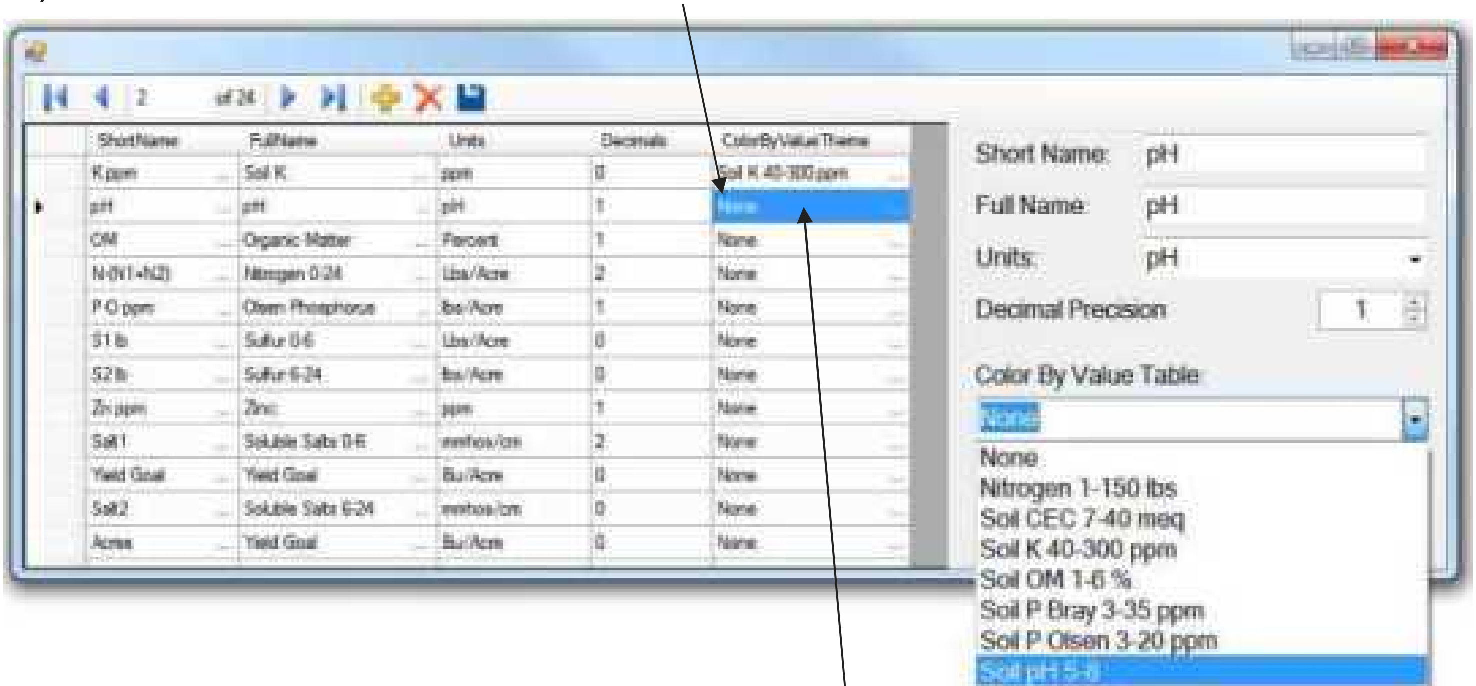
To open up the "Common Name Mapping" database go to Setup > Common Name Mapping at the top of the window.



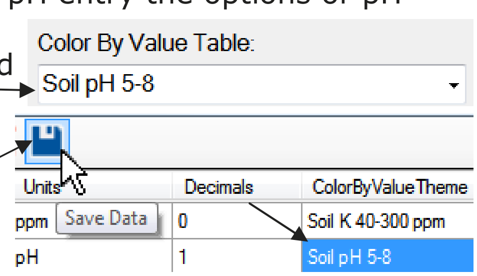
This will open Common Name Mapping.

All previous entries can be edited and have a color theme applied, removed, or changed.

By default all default entries will be set to "None."



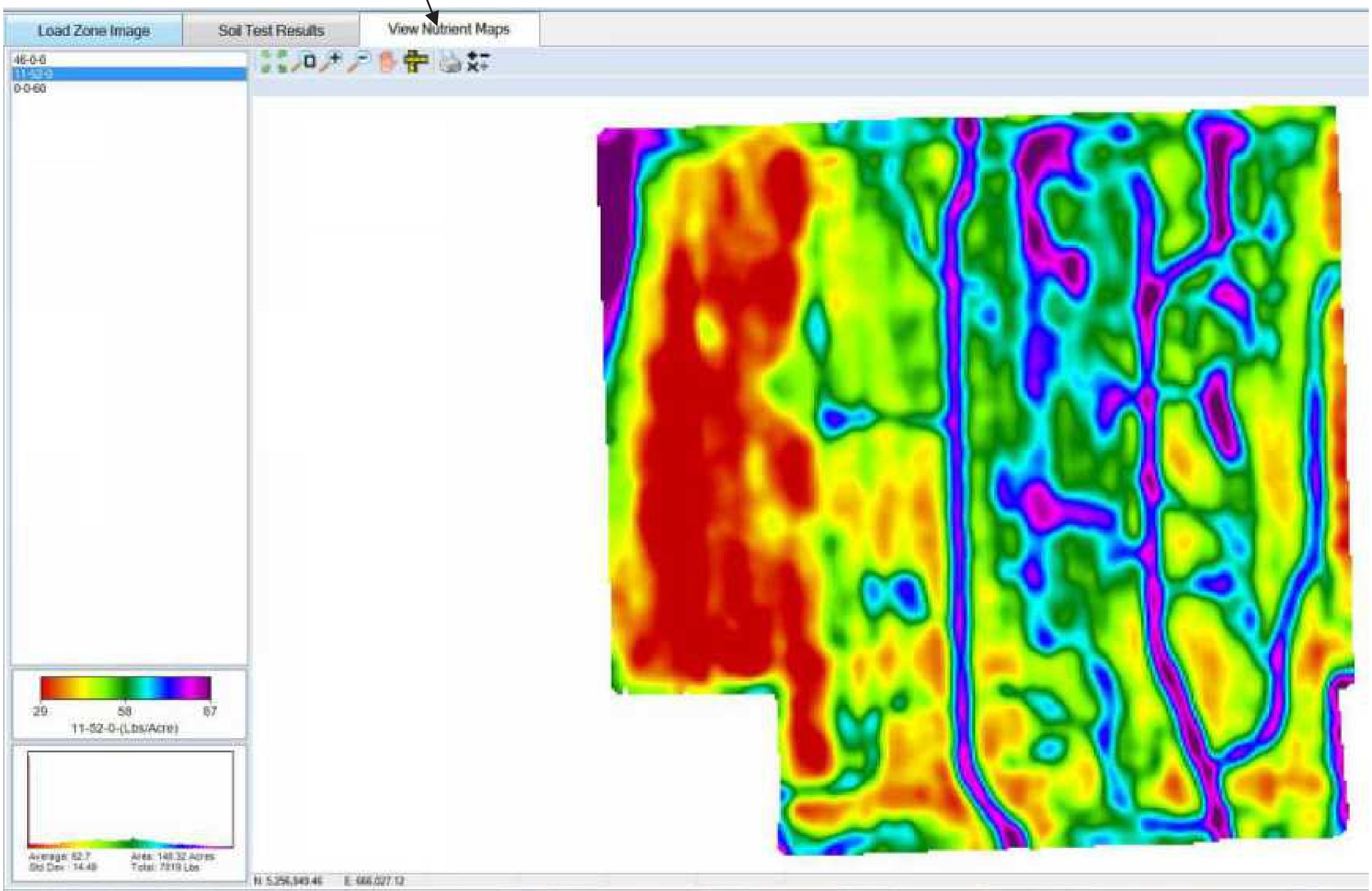
1. To change or edit an entry click in the ColorByValueTheme area for the name you wish to be change. This example will be pH. After clicking on "None" by the pH entry the options or pH layers are populated on the right side of the window.
2. In the "Color By Value Table" dropdown menu choose the desired theme.
3. After the theme is chosen click "Save" at the top of the widow.
4. Repeat for additional layers.
5. Exit out of the "Common Name Mapping" database.



Nutrient Layers

Creating Nutrient Layers Manually

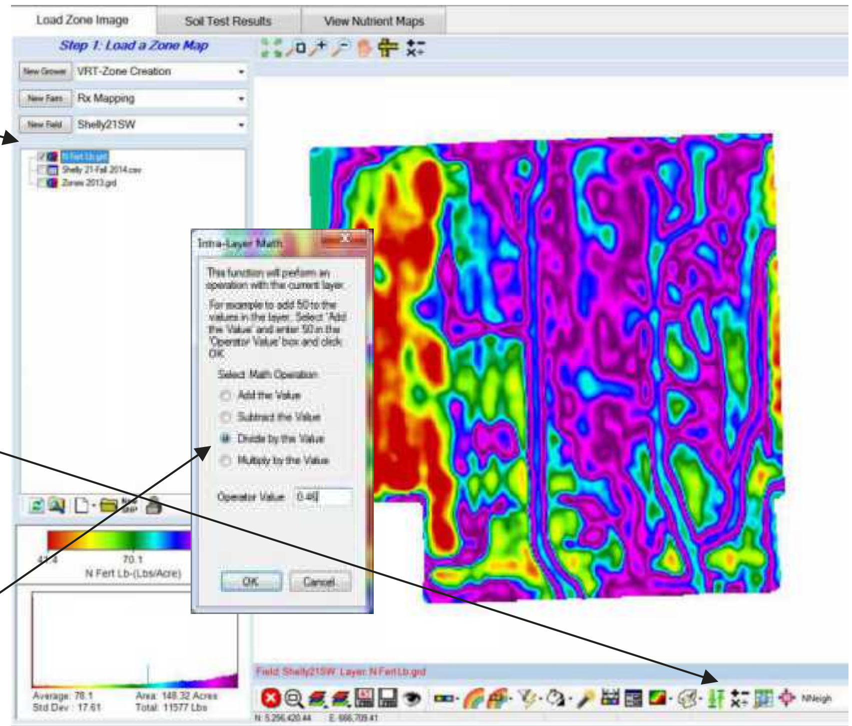
9. Select the **"View Nutrient Maps"** tab. You now have Nutrient Maps for each product you desire.



NOTE: In this example, if the rates were entered in LBS of Product (11-52-0 / 46-0-0) you are done. Go to "Map Window" for printing and exporting.

Creating Prescription Maps Manually

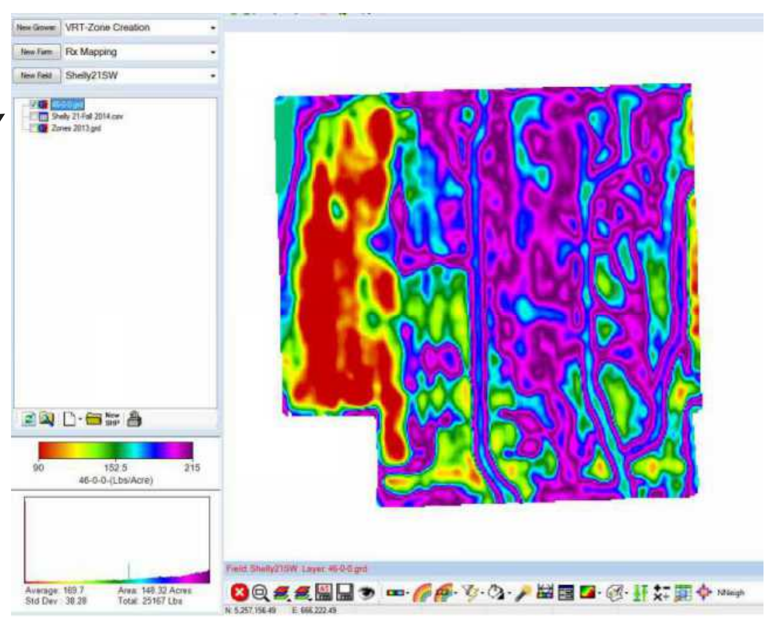
Adjusting Rates—Map Math



10. Go to **"Load Zone Image"** tab, and turn on the map you would like to use for the application (for example, we will convert the N Fert Lb to 46-0-0).

11. Select the **"Intra-Layer Math"** button. This will run the selected mathematical function over every pixel in the surface.

12. For this math, we will select **"Divide by the Value"** and **"Operator Value 0.46"**, click "OK".



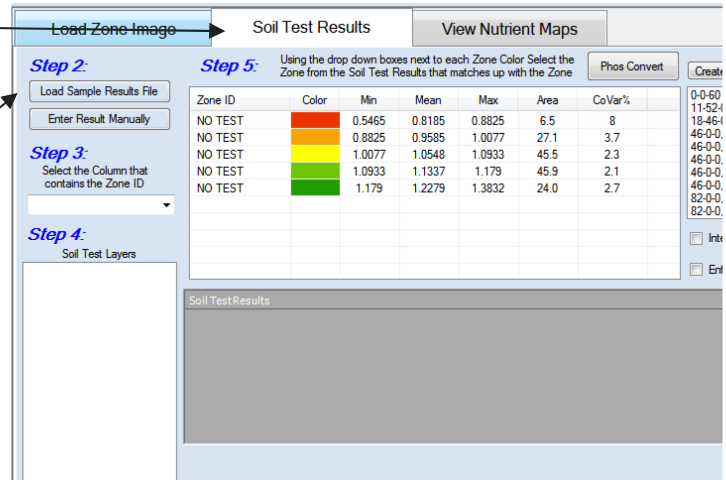
13. The map is now converted to LBS of Urea (46-0-0). Re-name or "Save As" to 46-0-0.grd as shown to the right and delete the "N Fert Lb."

14. Confirm the Correct Rates!

Nutrient Layers

Using CSV / XLS Soil Test Results

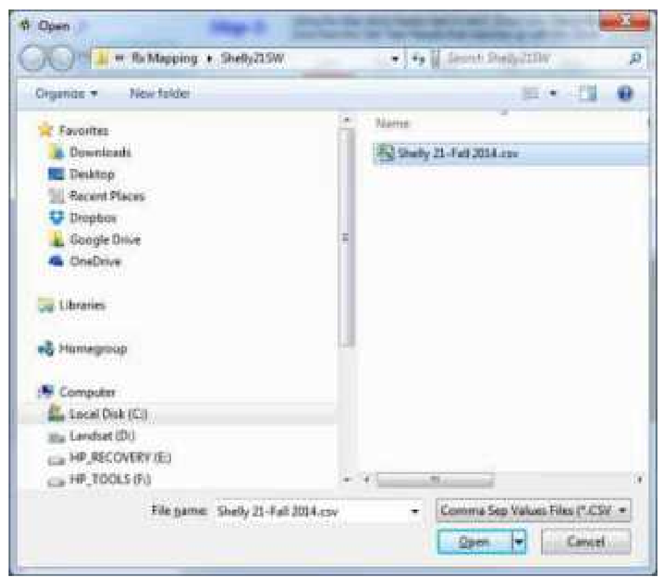
1. Next, select the **Soil Test Results** tab on the top of your Nutrient Layers window.



2. Select the **Load Sample Results File** button.

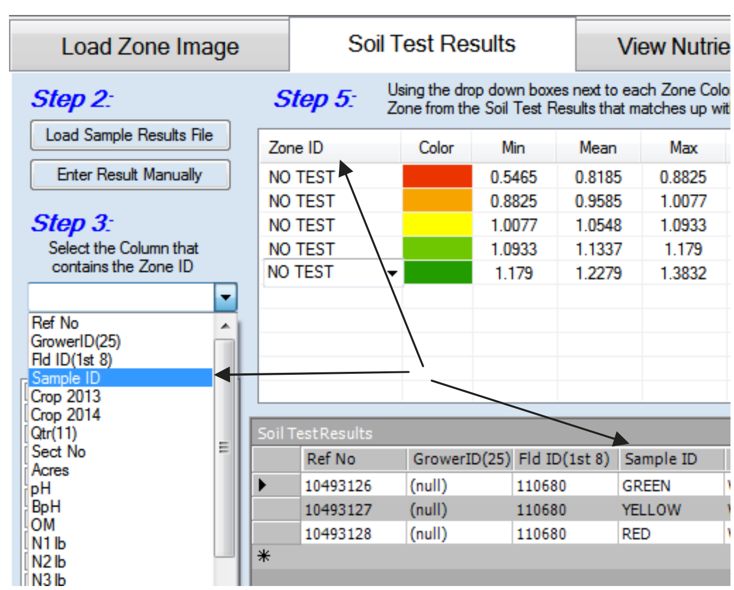
   A. These soil tests are normally exported from Agvisor Gold software as "Agvise with Recs" as CSV (Comma Separated Value). ADMS can accept files from other sources as long as they are in a .CSV format.

3. Locate the .CSV file and open it. (We recommend storing the soil test in the "Client" "Farm" "Field" and "Year" when you import results).



Note: *There is an option where to start browsing for soil sample results. Go to Tools > Settings > User Interface 2. At the bottom of the window there is the option to **"Start Search Results in Field Folder."** If this is checked windows explorer will open up to field location. If it is unchecked it will open to the last location.*

4. Step 3: **"Select the Column that contains the Zone ID",** select the appropriate column to reflect the Zone ID - Color (usually "Sample ID").



Using CSV / XLS Soil Test Results—Phosphorous Conversion

Soil phosphorous values may be tested and reported in several different ways such as Olsen, Bray, and Mehlich 2 & 3. Do to variables like pH differences, some samples may be tested as one type and other samples tested as another. For example a high pH test may have an Olsen result where a lower pH may have a Bray result. ADMS cannot distinguish these differences. So there are some conversion tools to update columns that may have zeros in them, or create a new column if the phosphorous result needs to be a certain type for recommendations or scripts.

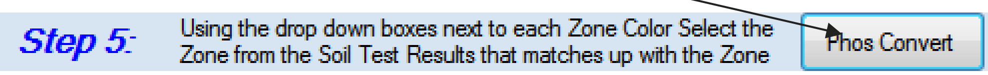
Updating Existing Columns

If there is a column that has only some values reported in it. It can be updated using the other Soil P column. For example these results have three zones reported as Olsen Values and only one zone reported as a Bray value.

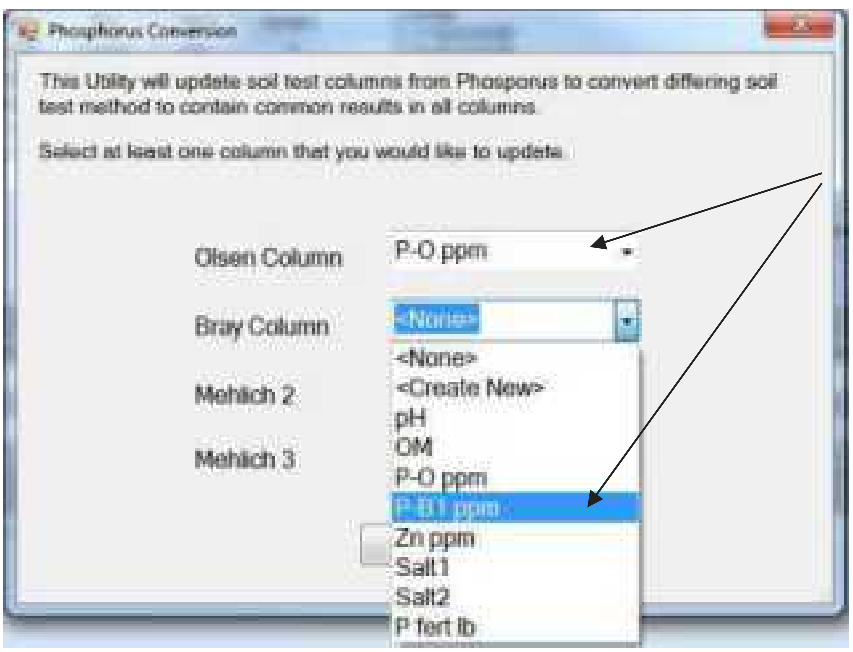
P-O ppm	P-B1 ppm
9	0
7	13.3
6	0

To report everything in P-B1 a conversion must be ran before the maps are created.

1. Click on the "Phos Convert" button.



The "Phosphorous Conversion" window will appear.



If the columns have values in them they will show up as a dropdown option.

2. Choose the corresponding columns.
3. To update values two columns must be filled in. ADMS will use the values in one column to convert to the other value. In this example the Olsen values will be converted to Bray (P-B1).
4. After the dropdowns are filled in click "Run Conversion."

5. After clicking "Run Conversion" the missing values will be updated.

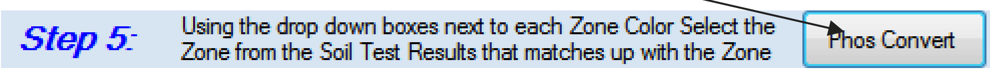
P-O ppm	P-B1 ppm
9	14
7	13
6	9

Using CSV / XLS Soil Test Results—Phosphorous Conversion

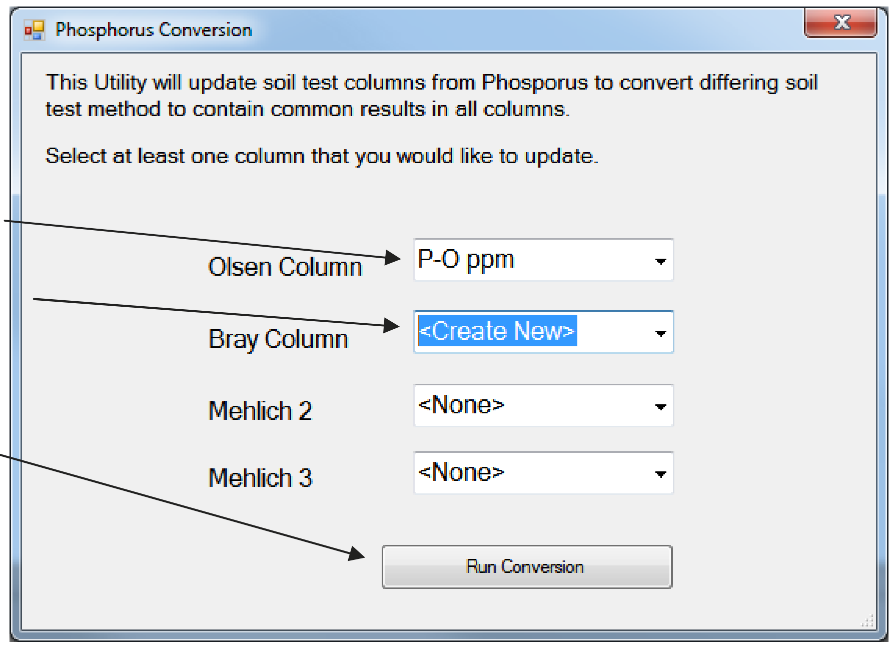
Creating New Columns

If soil test results are reported as one value, but they need to be converted to used in recommendations or scripts it can be done using the same tool. Instead of updating an existing column it will create a new one based on existing values.

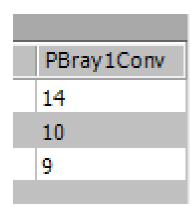
1. Click on the "Phos Convert" button.



2. The "Phosphorous Conversion" window will open.
3. Select the existing Soil Phosphorous column from the dropdown.
4. Select "<Create New>" for the soil test value that needs to be converted.
5. Click "Run Conversion."



After the phosphorous conversion has run it will create a new column of the converted soil test values.

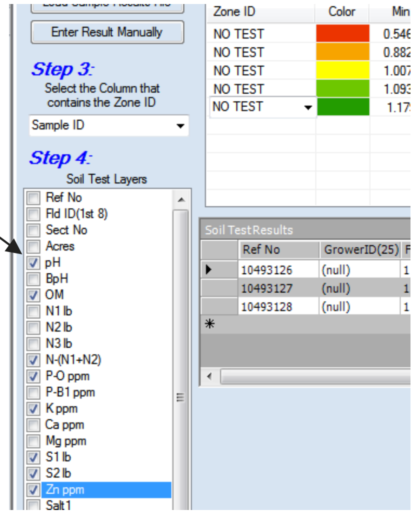


Nutrient layers can be built off of these the same as any other column.

Nutrient Layers

Using CSV / XLS Soil Test Results

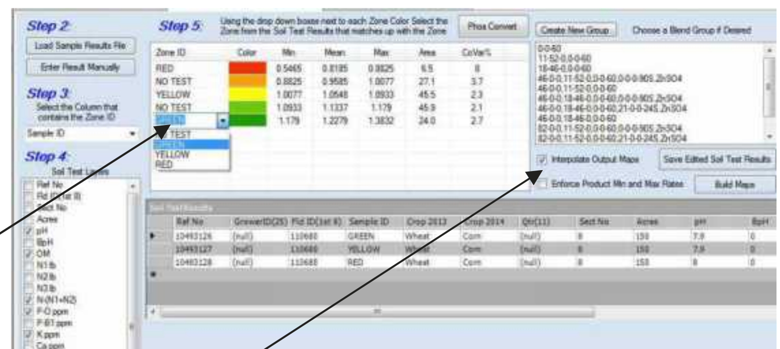
5. Select the **"Soil Test Layers"** you wish to create a Nutrient map for. This can be one layer for a single product application, or many layers for multi-product application.



6. Put a check mark in front of the products of the "Soil Test Layers" you would like to make maps for. By selecting the soil test results, you will produce a zone soil test map.

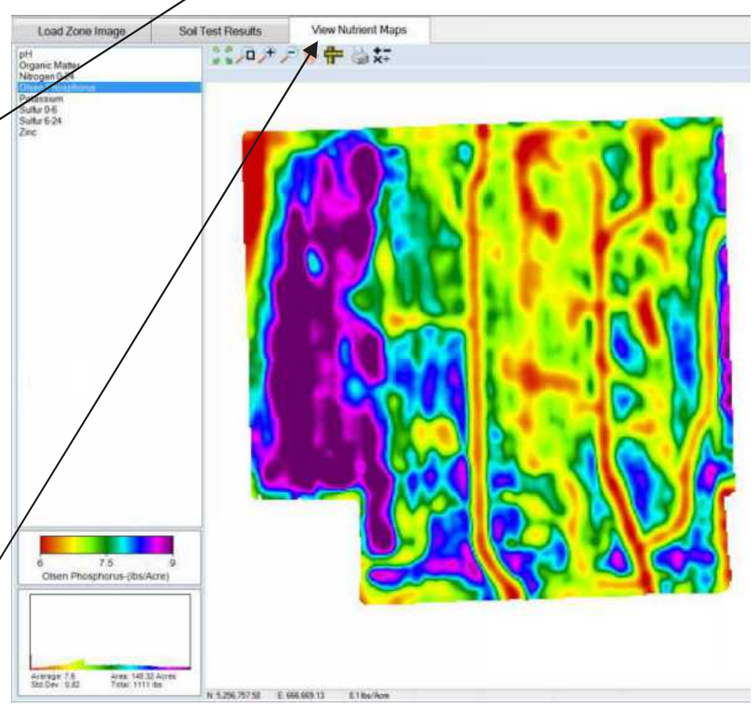
   Table Columns in Agvisor Gold are in Lbs of N / P / K (not Urea / MAP or DAP / Potash) and will **need to be converted**.

7. You can use values as LBS of Nutrient and convert later using steps 11 -14, or change the values in the "Soil Test Results" table.



8. Choose which Soil Test should be associated with which color Zone, using the Pull-down menu for each color. With a 3 zone soil tests and a 5 zone map, **<u>the remaining zones need to read "No Test</u>".**

9. With all these items selected, check **"Interpolate Output Maps"** and click **"Build Maps".** (By NOT checking the "Interpolate" box, you will get a 5 rate zone application map recommended for seeding maps).

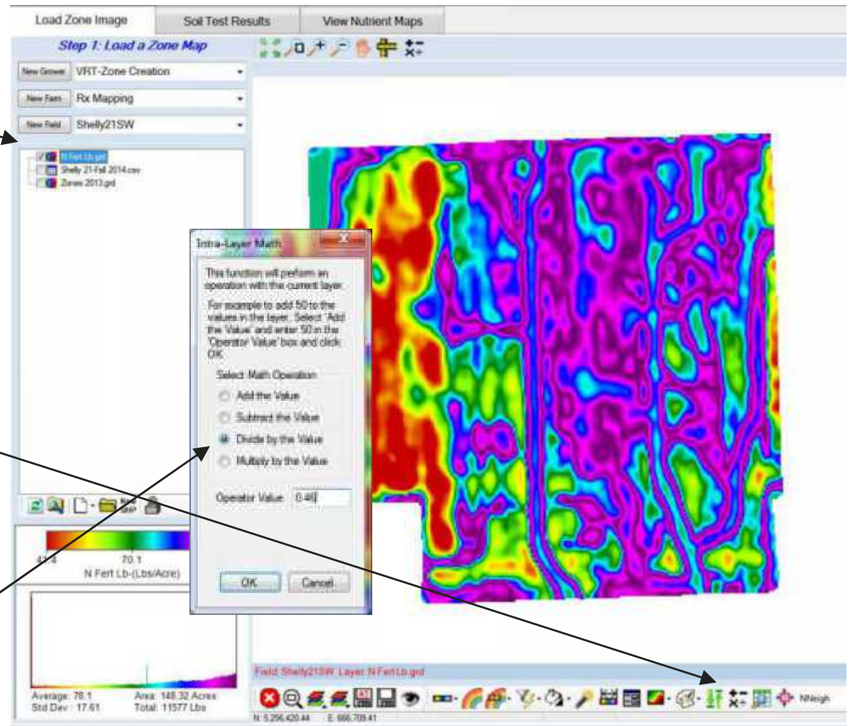


10. If soil test results have been edited then can be saved by clicking "Save Edited Soil Test Results."

11. Choose the **"View Nutrient Maps"** tab, and view the Nutrient Map(s) you created for each product.

Nutrient Layers

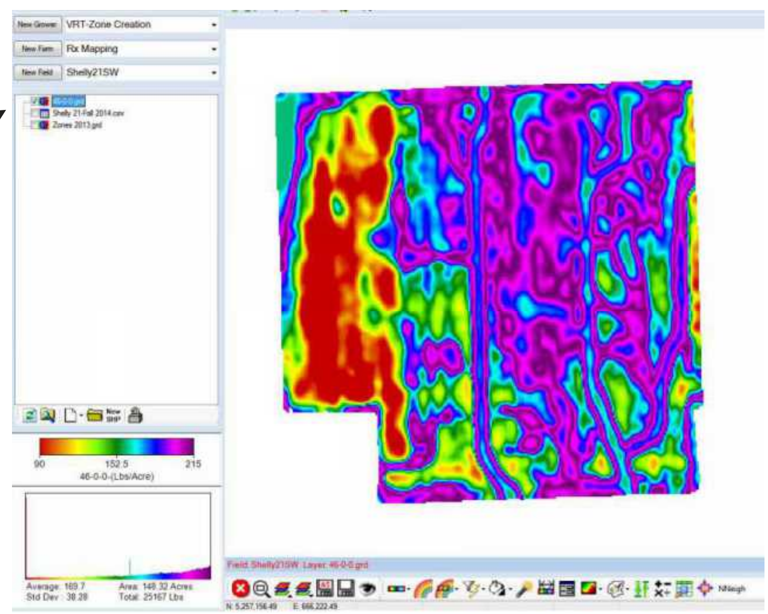
Using CSV / XLS Soil Test Results



12. Go to **"Load Zone Image"** tab, and turn on the map you would like to use for the application (for example, we will convert the N Fert Lb to 46-0-0).

13. Select the **"Intra-Layer Math"** button. This will run the selected mathematical function over every pixel in the surface. 

14. For this math, we will select **"Divide by the Value"** and **"Operator Value 0.46"**, click "OK".

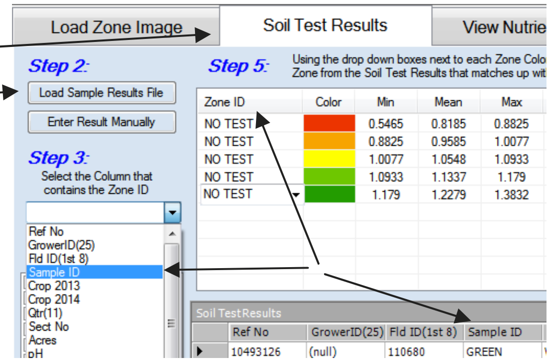


15. The map is now converted to LBS of Urea (46-0-0).

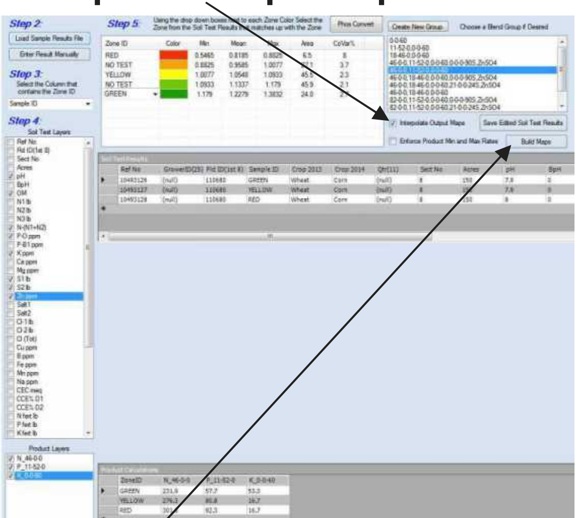
16. Go to the bottom tool bar and "Save As" 46-0-0.grd

Nutrient Layers

Using Blend Groups

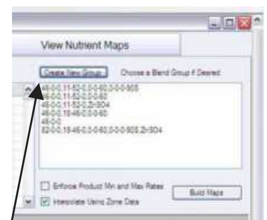


1. Select the **"Soil Test Results"** tab on the top of the Nutrient Layers window.
2. Step 2: Select **"Load Sample Results File"**
   a. These soil tests are normally exported from Advisor Gold software as "Prescription with Recs" as CSV (Comma Separated Value). We can accept files from many other sources as long as they are in a CSV format.
3. Step 3: **"Select the Column that contains the Zone ID",** select the appropriate column to reflect the Zone ID - Color. (Usually "Sample ID").
4. Choose a Product Blend Group to use. If you do not see the desired Blend Group, you need to create one.
5. Choose the preferred Product Blend Group. The Product Calculations Window at the bottom of the screen will show the amounts of each product that corresponds to the Zone ID's. **These values are in LBS of product Urea (46-0-0) not Nitrogen**.
6. Select the desired Product Layers.
7. With all these items selected, check **"Interpolate Output Maps"** and click

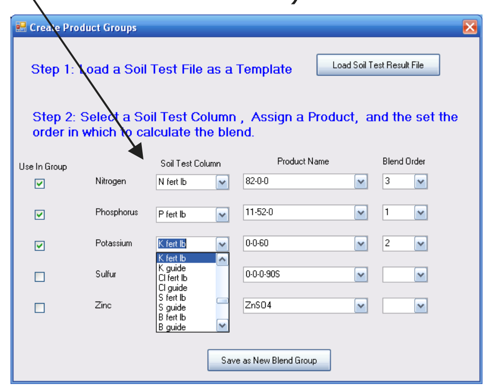


   "Build Maps" (by NOT checking the "Interpolate" box, you will get a 5 rate zone application map recommended for seeding maps).
8. Select the **"View Nutrient Maps"** tab and confirm the maps have all the correct rates.

Create Blend Group



a. Select the **"Create New Group"** button directly below the **"View Nutrient Maps"** tab.
b. Select **"Load Soil Test Result File"**, and choose a soil test to use.
c. Locate the Soil Test CSV (Comma Separated Value) file you're using for your soil test (this table layout and column names must be standard for all tests).
d. On the **"Soil Test Column"** pull-down menus, choose the Soil Test Column from the soil test that you want to use with the given Nutrient.



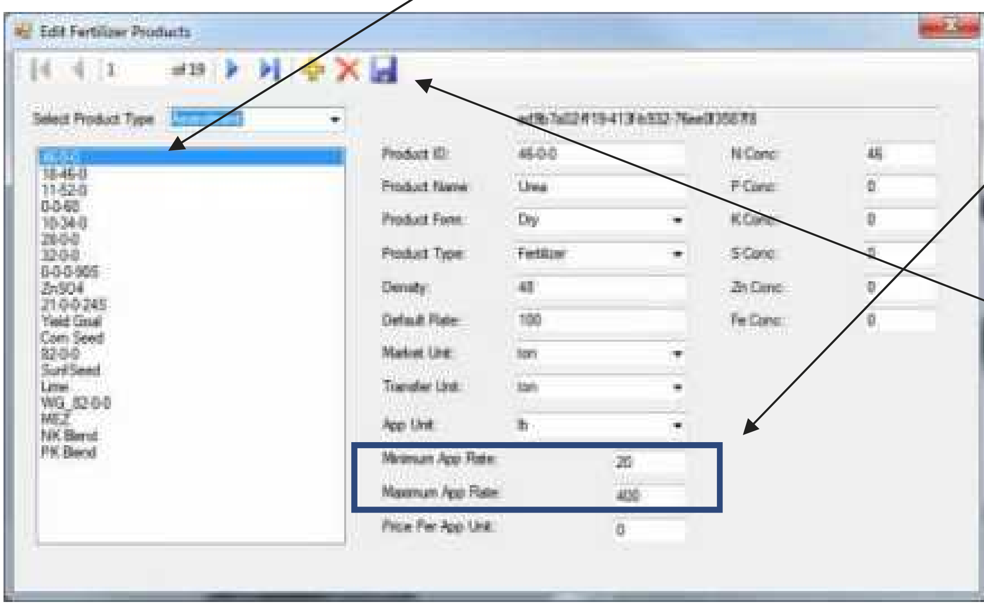
e. Check the boxes **"Use In Group"** for all the products you want and fill in the Dropdowns for that Nutrient.
f. Select what order you want these products built. Ex. #1 (11-52-0) #2 (0-0-60) #3 (46-0-0) This will account for the Nitrogen coming from the 11-52-0 and subtract it from the 46-0-0.
g. **"Save As New Blend Group"**

Enforcing Min and Max Rates

There are times when product application maps may need an minimum or maximum rate enforced. This is easily accomplished through the "Merge Zone Results" window when the application maps are created. To utilize this tool there the values have to be assigned in the fertilizer product database.

Setting Up Min & Max Rates

1. Go to Setup > Fertilizers
2. This opens the database where fertilizer products can be added, removed, or edited.
3. On the left select the fertilizer product.

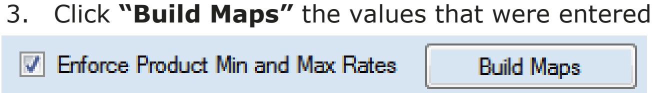


4. After the product is selected enter the Minimum and Maximum App Rate on the bottom of the window. These values will be enforced when the product maps are created.
5. When the desired rates are entered "Save Data" before moving on to the next product. 

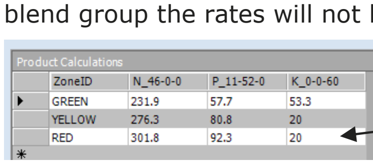
Applying Min & Max Rates

The min and max rates will be applied to maps created by entering results manually or using a blend group to create products.

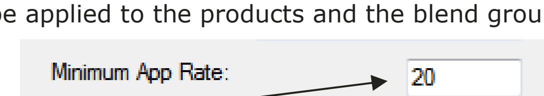
<u>Entering Results Manually</u>
1. Click "Enter Results Manually" (***Step 2***) and enter the product rates.
2. Before building maps put a check mark in front of **"Enforce Product Min and Max Rates."**
3. Click **"Build Maps"** the values that were entered in the database will be applied to the product map.



<u>Using a Blend Group</u>
1. Follow the steps on creating nutrient maps from a blend group.
2. **BEFORE** clicking the blend group to create products put a check in front of **"Enforce Product Min and Max Rates."** If it is selected after the blend group the rates will not be applied to the products and the blend group will have to be reselected.
3. Click **"Build Maps."**


Product Calculations

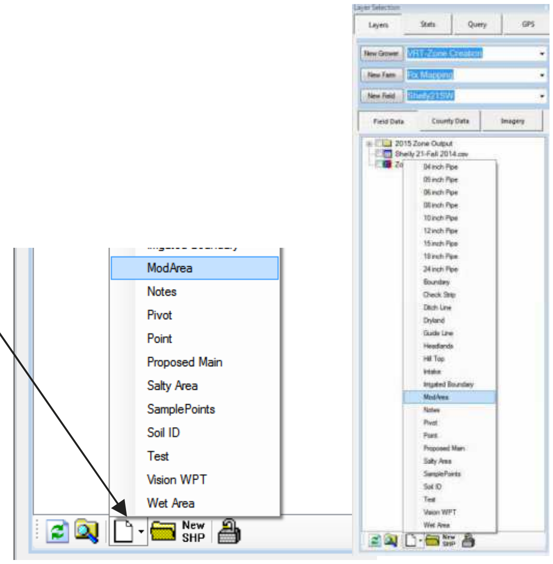
ZoneID	N_46-0-0	P_11-52-0	K_0-0-60
GREEN	231.9	57.7	53.3
YELLOW	276.3	80.8	20
RED	301.8	92.3	20



Creating a "ModArea" or "Check Strip" & Editing Raster Values

1. Turn on the map that is to be modified. (i.e. NH3 or Urea VR map.)

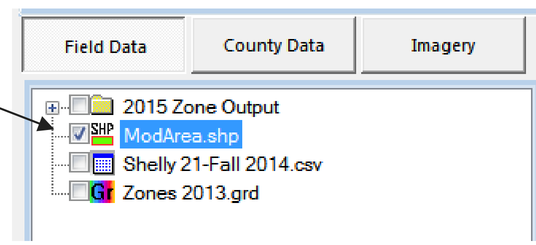
2. Click on "Create New Layer From Template".



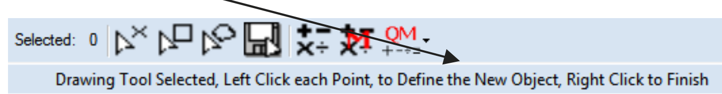
3. Select "ModArea" from the list (You may have fewer options).

4. Now you should have a new shapefile called "ModArea.shp" appear in your data tree. If you do not, click the "Refresh" button. 

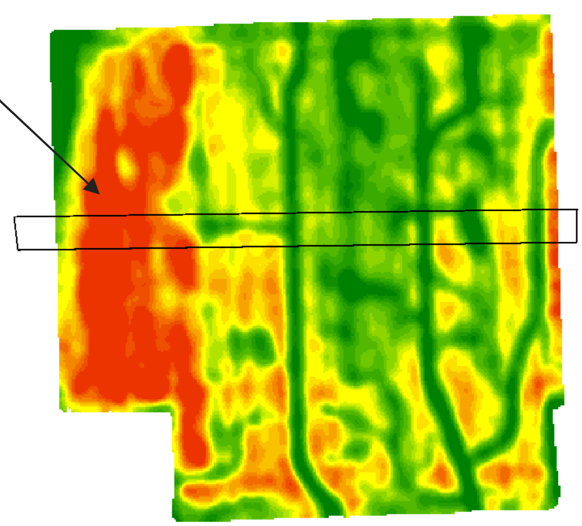
5. Now Check the "ModArea.shp" to turn it on & make it the Active Layer (**Shown here in RED**).



6. Now click on the **"SHP"** button on the bottom toolbar to start drawing the modification area. *(Take note of the instructions at the top of the screen.)*



7. Now draw your modified area. *(Take note of the Length and Bearing to help with drawing.) To the right is an example of a check strip "ModArea".*



8. Finished Drawing the ModArea. Go back to step 6 if you want to have more areas in the field. Repeat as needed.

9. Click the "Save Changes" when finished.

Nutrient Layers

Creating a "ModArea" or "Check Strip" & Editing Raster Values

1. Make the "ModArea" the active layer

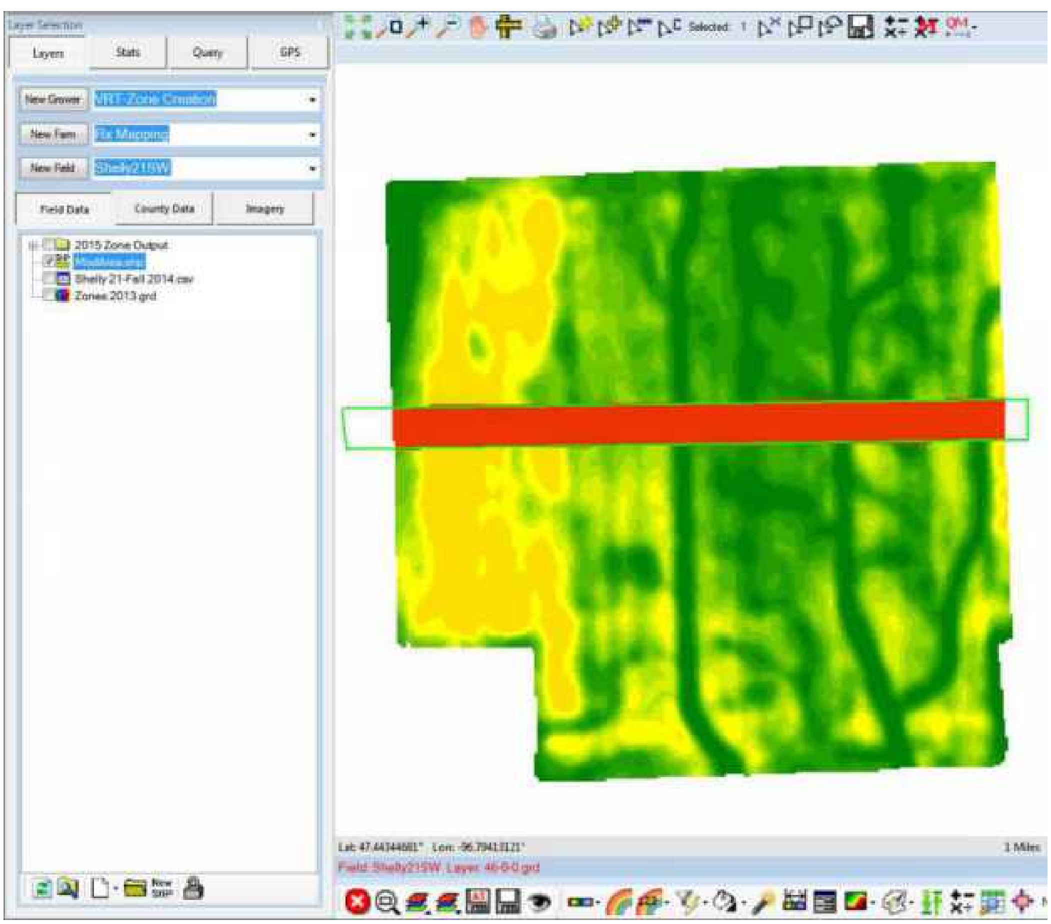
2. Select the "ModArea" objects you want to amend by "Left Clicking" in the object in the MAP WINDOW *(Hold the "Ctrl" key to choose multiple objects)*

3. Turn on your Surface Map to amend *(Ex. 46-0-0.grd)*

4. From the bottom tool bar, click on "Apply Mod to Selected Polygon" 

5. "Modify Pixels Under Drawn Area" Window will open. You can now assign a value or add / subtract / multiply / divide the pixels in the ModArea.

6. Click the "Save Changes" when finished *(you may want to do a "Save As" & Re-name if you want to keep the original object)*



Creating a Yield Goal Map

Adding a Yield Factor

- Often a yield goal will be used in the equations for creating fertilizer prescriptions.
    - There are several different ways you can obtain a yield goal map
        1. **Using Imagery Zones - Adjusting Ranges**
        2. **Using Imagery Zones - Assign New Values**

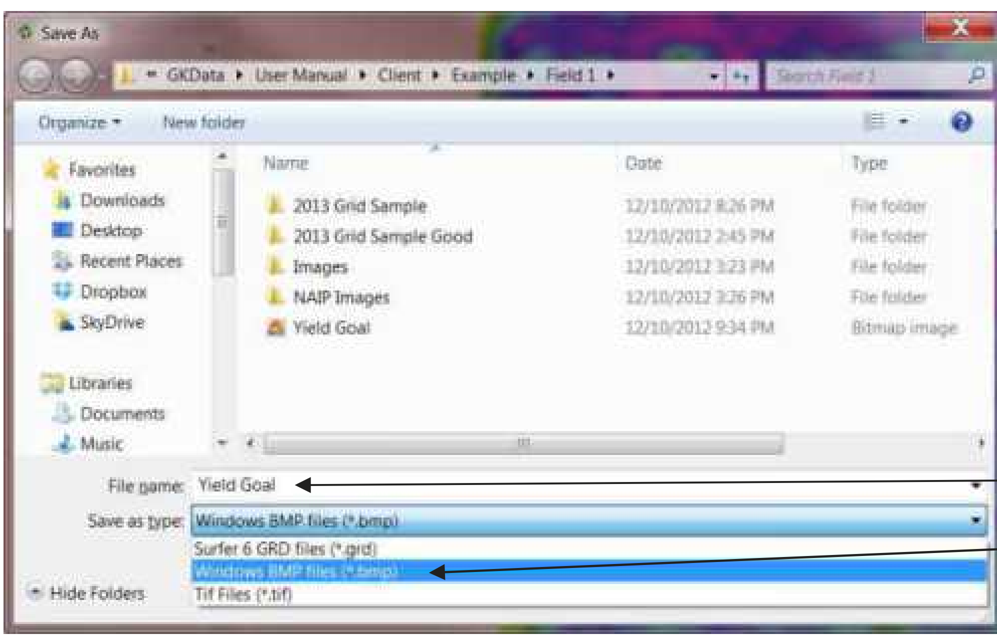
Creating a Yield Goal Map Using Imagery

* Follow the **Creating Zones From Imagery** section to obtain a zone map with an accurate representation of the field you are working on

- Once you have an acceptable zone map, yield values will have to be associated with it.

Method 1 - Adjust Ranges of Imagery (Zones)

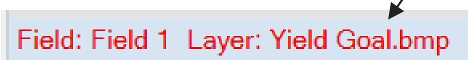
1. Select the Zone map *.grd file and make the active layer
2. Click "Save As" on the bottom toolbar below the map window

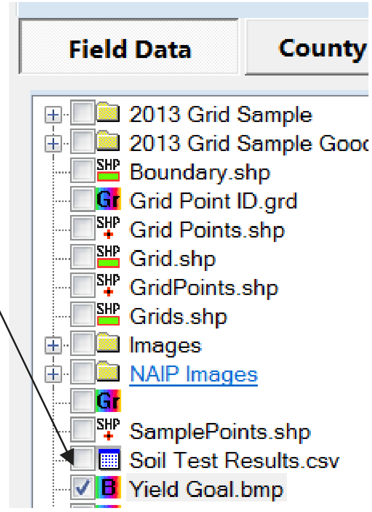


3. Rename to "Yield Goal"
4. Save as Windows BMP files (*.bmp)

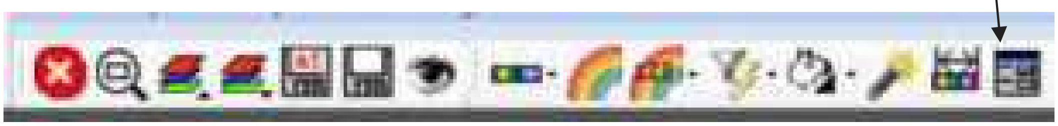
Creating a Yield Goal Map

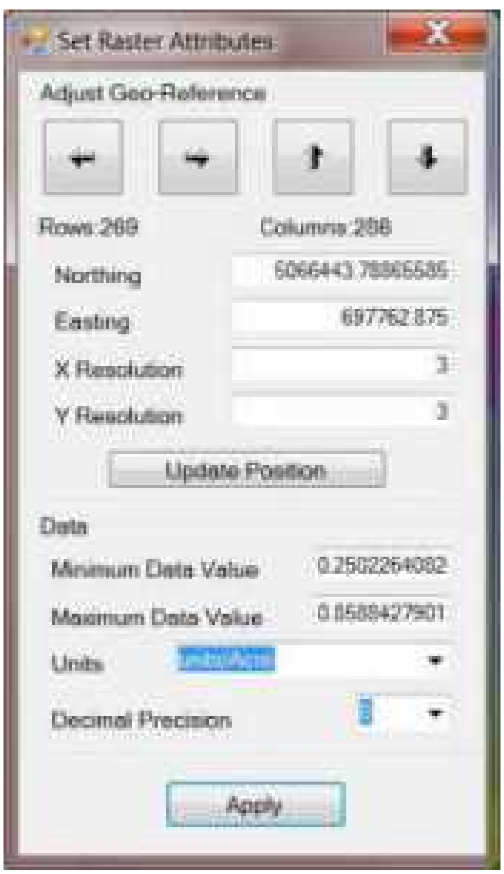
5. Under "Field Data" make the yield goal .bmp file the active layer



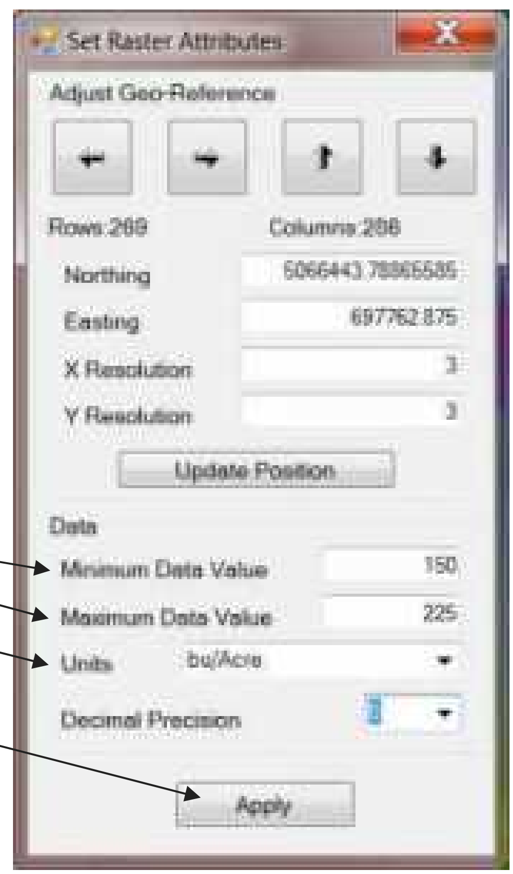


6. On the bottom toolbar below map window select the "Surface Properties" button.



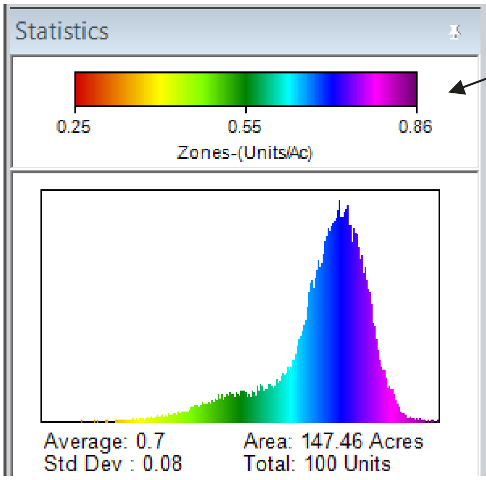


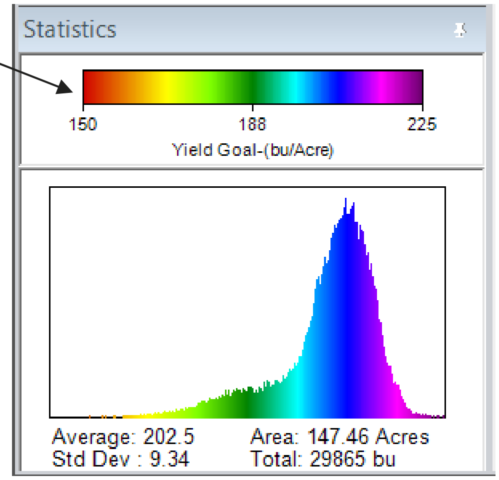
Select
Min Yield Value
Max Yield Value
Units/Acre ==> Bu/Acre
Click "Apply"



Creating a Yield Goal Map

This will shift the scale values to make it more represent yield more closely.





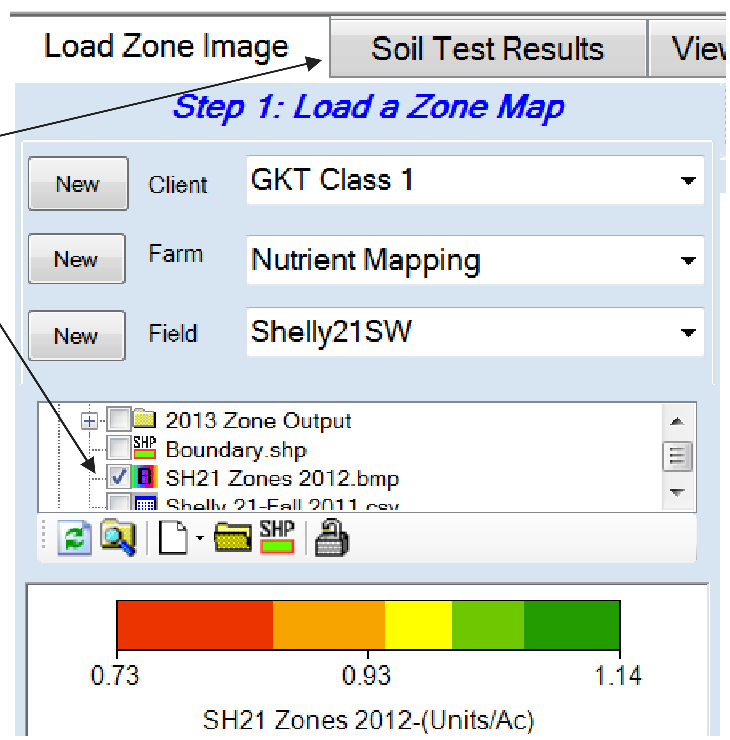
There is now an amended "Yield Goal.bmp"
To Finish Click "Save"

Method 2 - Assign New Values to Imagery

1. Go into the "Merge Zone Results" Window

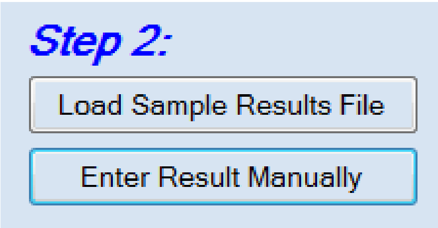
2. Select the zone map you are using

3. Go to "Soil Test Results" tab



Creating a Yield Goal Map

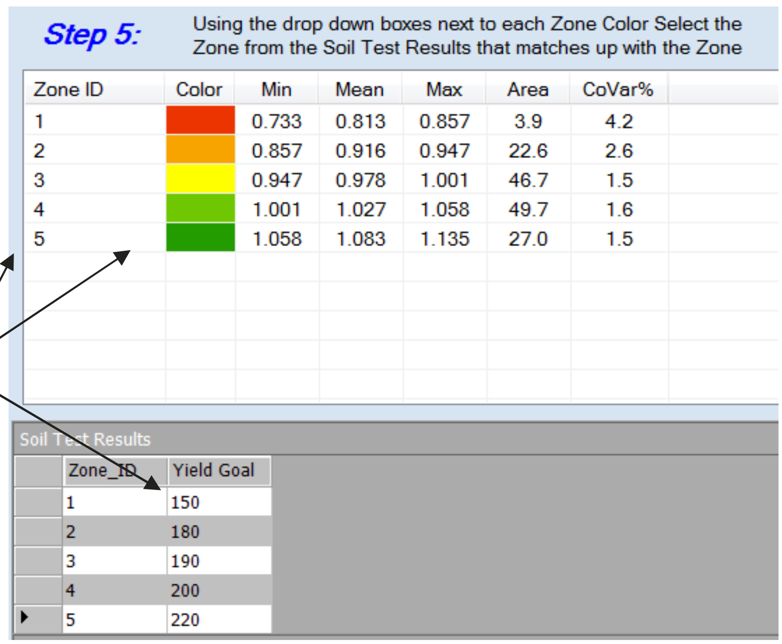
4. Select "Enter Result Manually" at Step 2:



5. Choose "Yield Goals" & Click "OK"

6. Assign yield values to each of the zones.

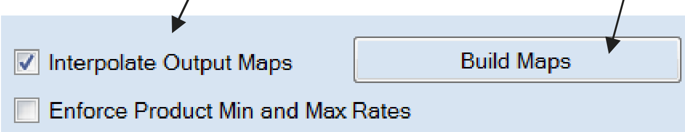
7. Type in the yield value in the Yield Goal column under "Soil Test Results" to correspond with the correct Zone ID and color.

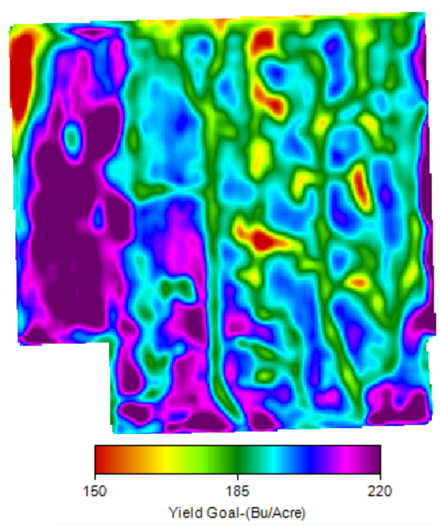


Zone ID	Color	Min	Mean	Max	Area	CoVar%
1		0.733	0.813	0.857	3.9	4.2
2		0.857	0.916	0.947	22.6	2.6
3		0.947	0.978	1.001	46.7	1.5
4		1.001	1.027	1.058	49.7	1.6
5		1.058	1.083	1.135	27.0	1.5

Zone_ID	Yield Goal
1	150
2	180
3	190
4	200
5	220

8. Select Interpolate Output Maps then the "Build Maps" button



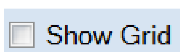


9. Go to the "View Nutrients Maps" tab to see your Yield Goals.grd maps

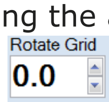
My Notes

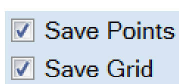
Quick Notes For Grid Sampling

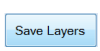
1. Setting Up a Grid

1. Go to “Map Window” or “Log and Sample”
2. Select the field from desired client, farm, and field.
3. Turn on field boundary and any desired background map (County NAIP)
4. Go to GPS mark in the top right hand corner of Layer Selection
5. Select Grid
6. Select your field boundary from the “Bound the Grid to this Layer” dropdown.
7. Select the desired X and Y dimensions of the field grids. Click **“Apply”**
8. Check on the show grid box 

9. Align the grid over the field using the up, down, side, to side arrows 

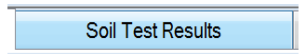
10. Rotate the grid if needed by typing in a number or using the arrows in the rotate grid box 

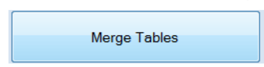
11. Check Save Grid & Save Points 

12. Click Save Layers 

and select the location to save them to and the desired name
13. By default the grid and grid points will be stored under your field data folder for the field you are working on

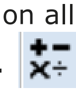
2. Merging Soil Test Results

1. Go to Merge Grid Results section on main screen, or go to the top and select process => Merge Grid Results
2. Locate the field from the client, farm, field and select the sample points and the boundary of the field
3. Go to the Soil Test Results tab on the top middle of the screen. 

4. *Step 2:* Click load sample results file button and search for your *.xls or *.csv file containing test results
5. *Step 3:* Assign the appropriate columns for the Sample ID on your Samples and Sample ID on the test results
6. *Step 4:* Check which layers you want to build maps for, columns containing any null values will not work (can replace these with zero values so they will merge)
7. Click Merge Tables, the test results should merge with the grid Sample ID file 

8. You can now choose to build your maps with Surfer Kriging or Inverse Distance which is default (Kriging smooth's the maps out and requires demo of Surfer 8)
9. Click the Build Maps button 
10. Click on the View Nutrient Maps tab to preview the created nutrient maps
11. Your nutrient maps will be automatically stored under a Grid Sample Folder under “Field Data” with the year of the growing season (set in settings/user interface 2) in front of it.

3. Writing a Prescription Using Scripting

1. Go to “Field Data”, check on all of the layers you will be using in the script. Click on the “Map Math” button on the top toolbar. 

2. Open the desired script you want to use 

3. Assign all the selected nutrient layers in the scripting window => Compile Script => Run Script

4. Click the output layers and “Save As.” => Rename as the created product. => Repeat Steps for all products.

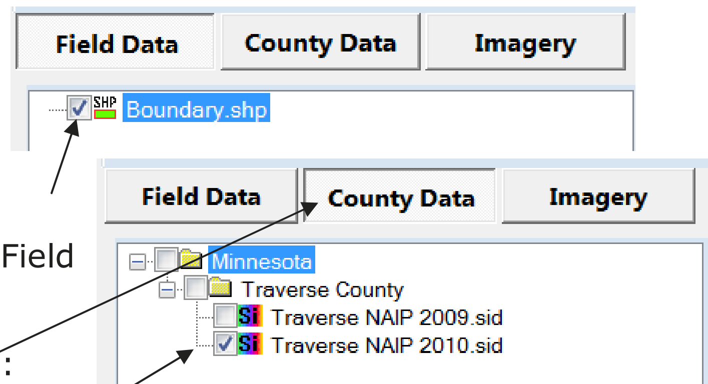
Grid Sampling—Setting Up A Grid

In this section, we will discuss grid sampling. We will explain how to lay out your grid, take the samples, create nutrient maps, set yield goals, and combine them all to create your prescription.

Creating a Boundary

- Refer to the section in the book—***Drawing Layers (Shapefiles—Vector Data-Polygons, Lines & Points)***
- You can create a boundary with GPS in field (recommended), hand draw it, or from a CLU FSA file

Setting Up a Grid



- You can do this in the "Log and Sample"

Window or "Map Window."

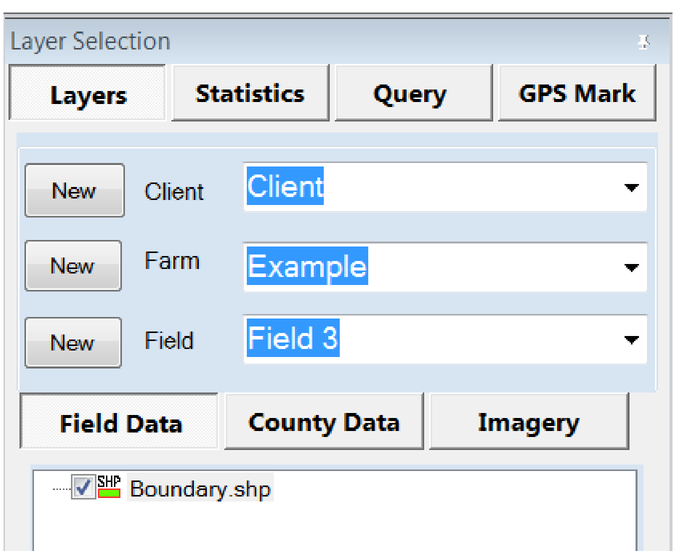
1.Check the boundary of the field under "Field Data"

2.If you wish to have a background image:

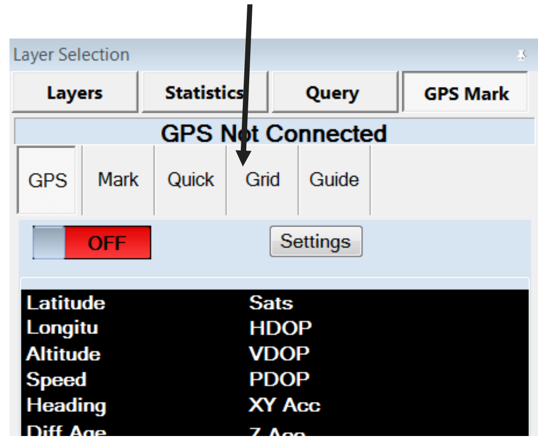
- Go to your "County Data" tab
- Check a NAIP Image for the county you are working in

***If the boundary is selected first, it will zoom to the field**

3. Once you have the boundary and background images both selected, go to the "GPS Mark" button on the top right of the layer selection options.

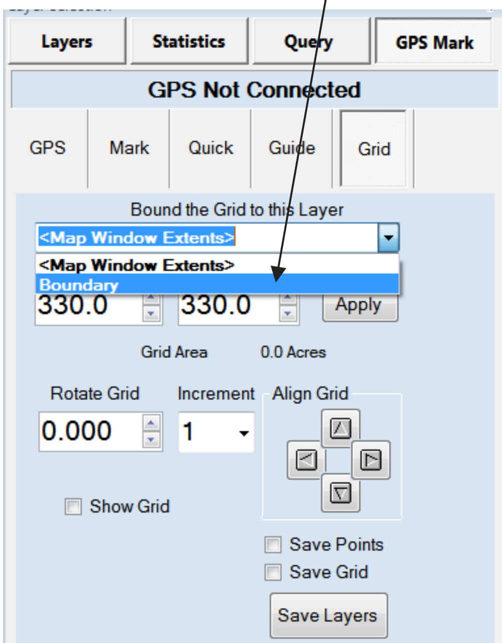


4. Next, select the "Grid" button

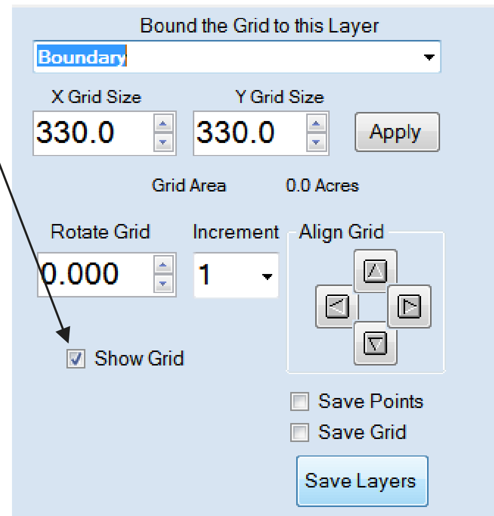


Grid Sampling—Setting Up A Grid

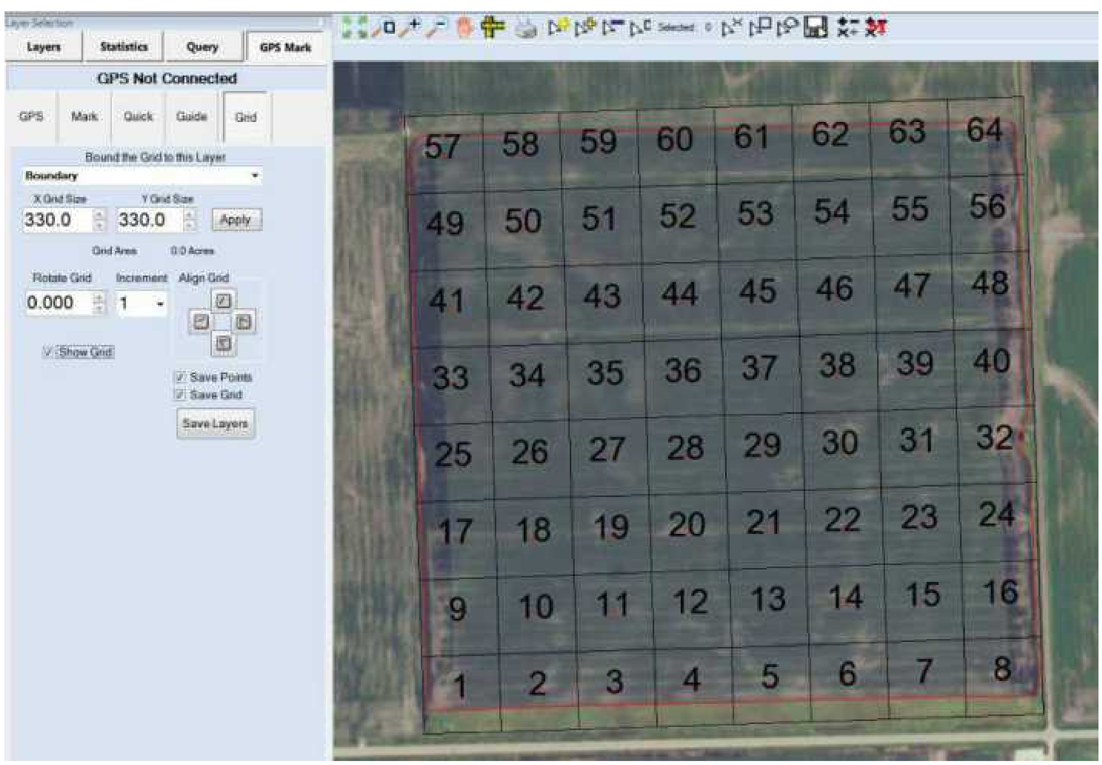
5. From the drop down menu select your boundary which was turned on. Click "Apply"



6. Check the "Show Grid" Box



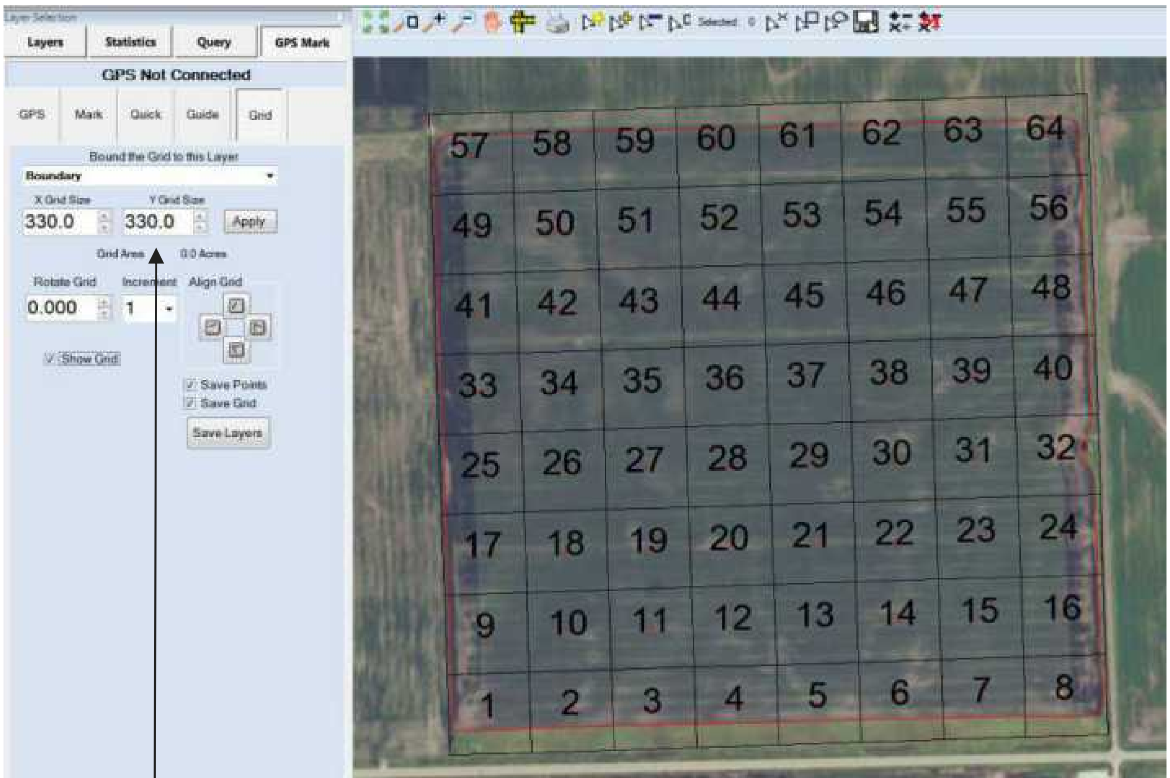
Your screen should now look similar to the image below. The grid size will be defaulted to 330 X 330. From here you can adjust grid alignment, rotation, size, and save your grid and points.



Grid Sampling—Setting Up A Grid

Adjusting Grid

Using the options below, you can adjust the alignment size, and rotation of the grid.



Adjusting Size

- You can adjust the size of your grid by inputting your desired X and Y lengths in the boxes. This can be done by using your key-board, or using the number pad that appears when you click on the "1 2 3."

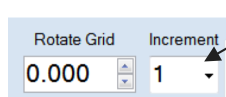
Common Grid Sizes

2.5 Acres	330 X 330
4.5 Acres	442.7 X 442.7
5 Acres	466 .7 X 466.7

Adjusting Rotation and Alignment

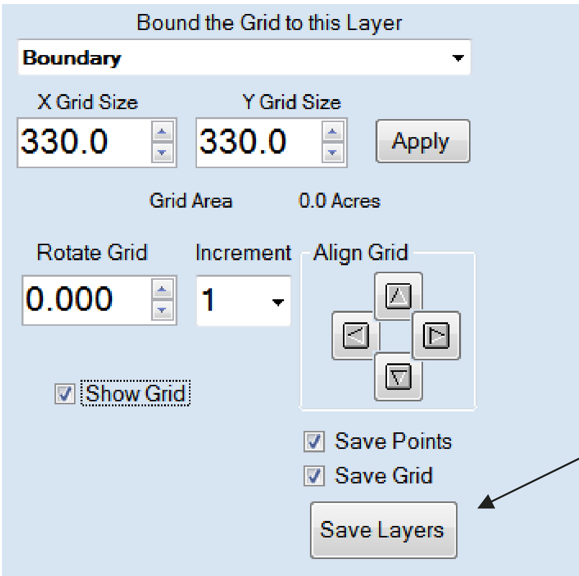
- The alignment (Up & Down, Side To Side) can be adjusted by using the arrows until you are satisfied with the alignment of the grid.

- The grid can also be rotated. To do this, you can use the up & down arrows on the "Rotate Grid" box or you can enter a value with your keyboard.



Increment—Allows for smaller movements of the grid rotation as 1, 0.1, or 0.01

Grid Sampling—Setting Up A Grid

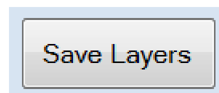


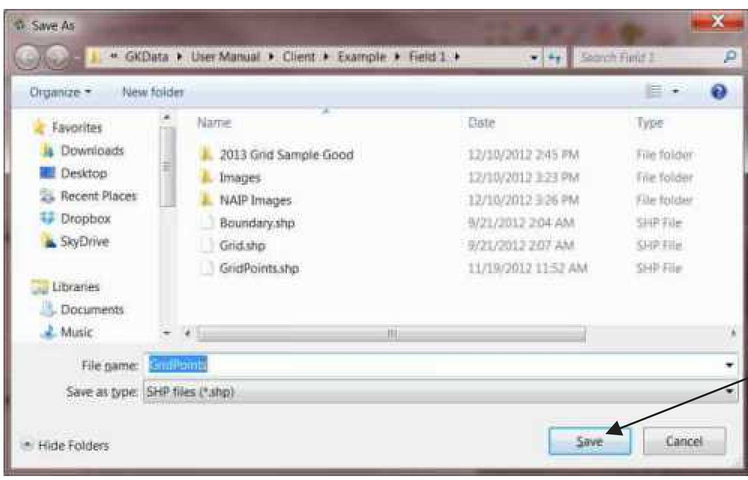
Saving Your Grid

- When the grid is in the ideal position
- Click "Save Layers"

Save the Points & Grids

1. Check "Save Points" & "Save Grid"
2. Once they are checked on, click "Save Layers."

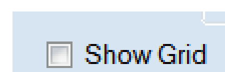


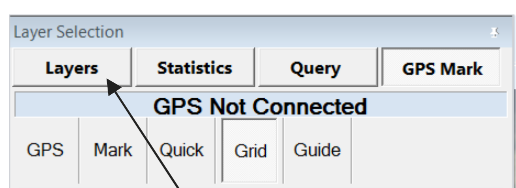


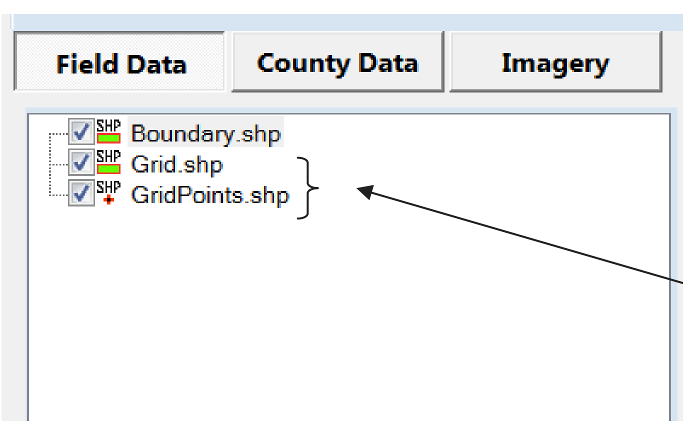
3. Choose the location of where you want to save the layers and their names

**It will be defaulted to your "Field Data" for that field and saved as Grid & GridPoints*

4. Click "Save."
5. Uncheck "Show Grid."







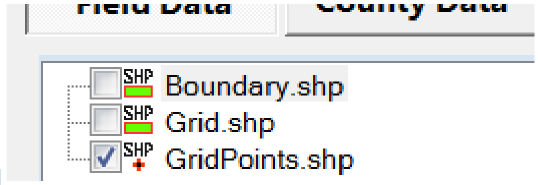
- Go back to the "Layers" tab
- Grid Points & Grid Polygons should now be located under your "Field Data" tab.

Grid Sampling—Labeling The Grid

Labeling Grid Points

- You can now choose which label your grid points have when you are out in the field sampling.

1. Check "GridPoints"
2. Select the "ABC" option below the map window



Note: make sure your grid points is your active layer

3. The label options box should come up

** Make sure "Labels Visible" is selected*

4. From the dropdown menu, you can select which data points you want to show up as labels.

Example "PointID"

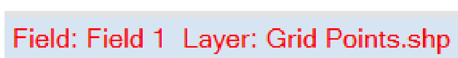
5. You can also select:

⇒ **Size, Font, and Color**

6. Click "Apply"

Changing Point Size & Color

You can also change the size and color you wish the grid points to appear



1. Make sure your active layer is the grid points.
2. Select "Change Draw Style" on the bottom toolbar

3. From the options, you can select the color and size of the points.

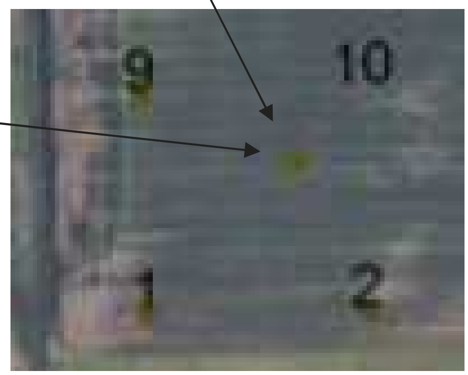
⇒ Fixed Sizing—Always equals that pixel size

⇒ Scaled Sizing—Size changes when you zoom in and out

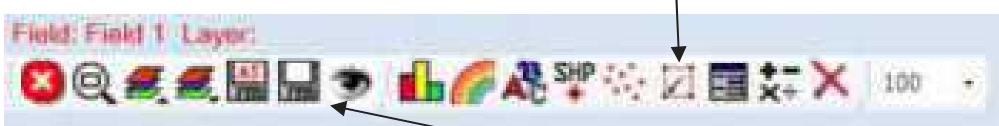
Then, select **"Apply"**

Grid Sampling—Moving Grid Points

1. Hover over the point. The cursor should change to a four directional arrow.
2. Click on the point you wish to move and drag it and drop it to the new desired spot.



3. When done, make sure you **<u>de-select</u>** the “Move Vertices of Selected Objects” tool.



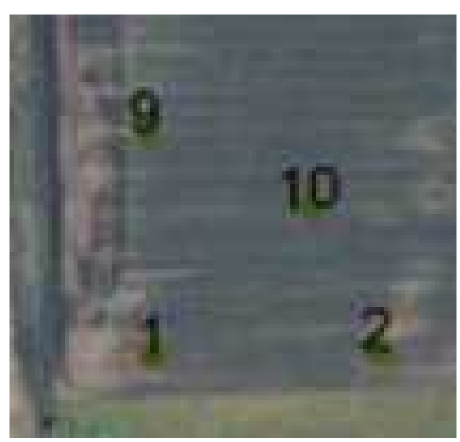
4. If the point is in the desired location, make sure you save the layer.

Notice the label does not move with the point at this point

To get the label to move with the point, we need a redraw of the screen:

1. Right click on the Grid Points.shp name
2. Select Unload Layer
3. Check on the “GridPoints.shp” File

The labels should be moved so they are next to your points.

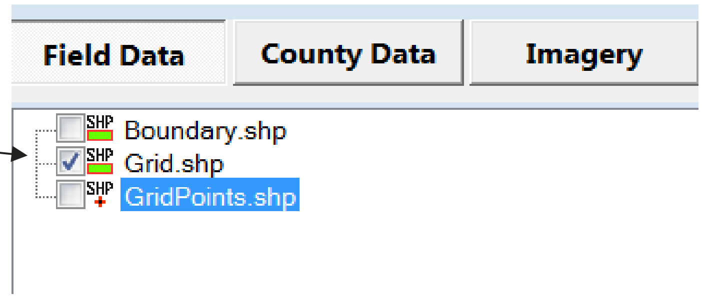


Grid Sampling—Creating Custom Grid Points

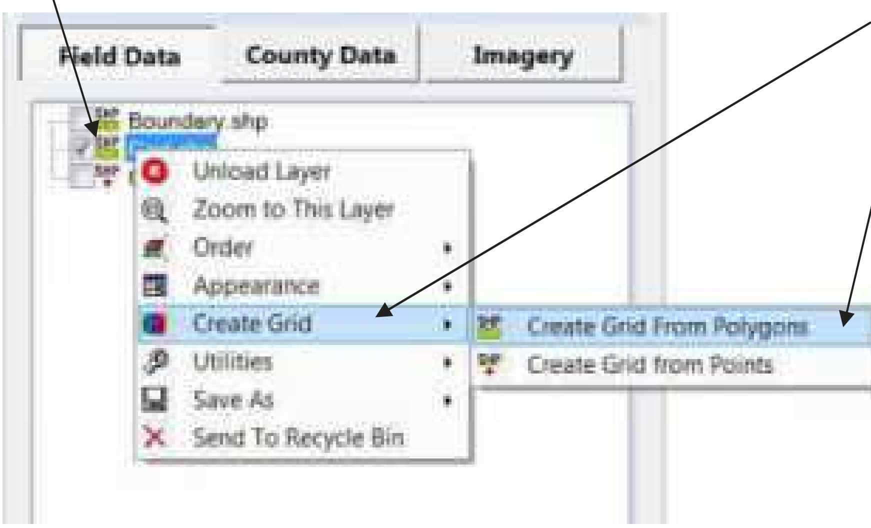
Creating a Custom Grid

If you have followed the previous steps, you will have a grid polygon file that shows the grid squares. This is the file we will be using for this portion of creating a custom grid. If you have not done this, go back and follow the instructions on how to create the grid polygon file.

1. Check the grid polygon shape file under "Field Data."

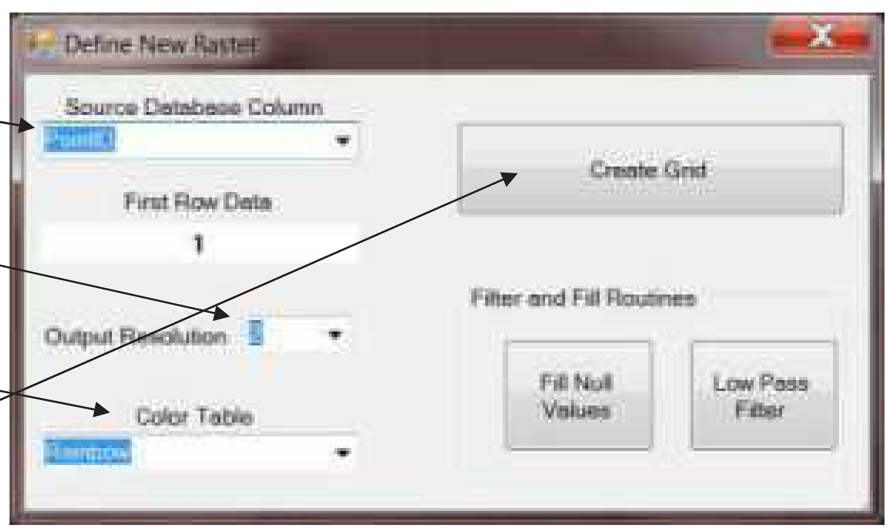


2. Right Click on the File

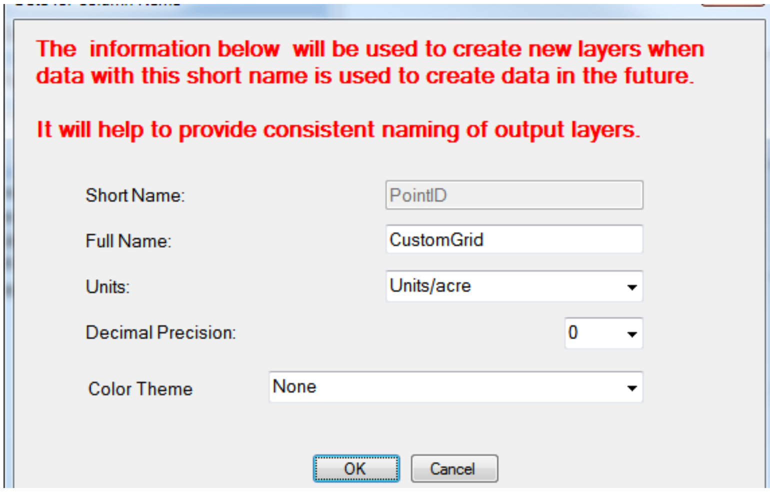


3. Go to "Create Grid"
4. Select "Create Grid From Polygons"

5. Select PointID in the "Source Database Column"
6. Select the output resolution
7. "2" Meters (recommended)
8. 7. Choose a "Color Table" . (Example—Rainbow)
9. 8. Click the "Create Grid" Button



Grid Sampling—Creating Custom Grid Points



Common Name Mapping

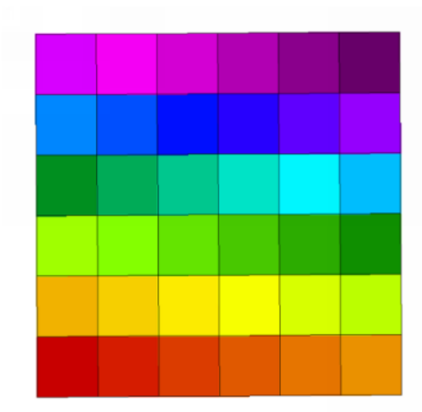
⇒ If you have not done this before, a window will appear and ask you what you want to call your new layer.

⇒ **DO NOT** name it according to the field.

⇒ This name will be used every time you create a grid from polygons and use PointID as your source column

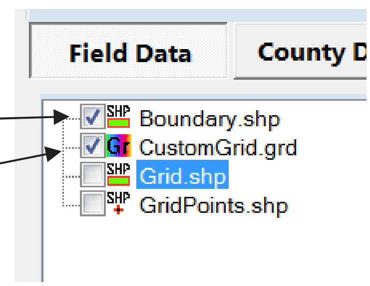
⇒ Make sure you fill in all the information or you will get an error

- **Your grids should now be colored and look similar to this**



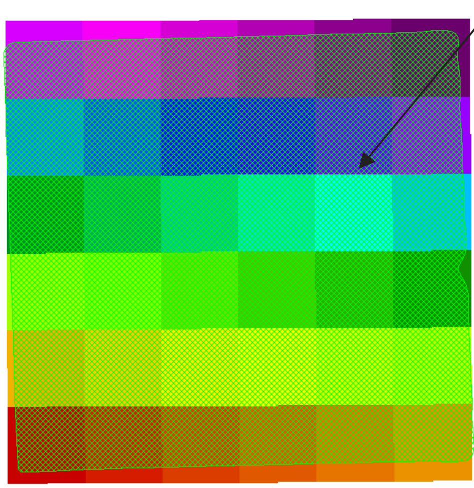
Cropping to Field Boundary

To make sure your points will be within the field, crop this layer to your field boundary.



1. Click "Clear Map"
2. Check the boundary under "Field Data"
3. Check CustomGrid.grd file
4. Make the boundary your active layer

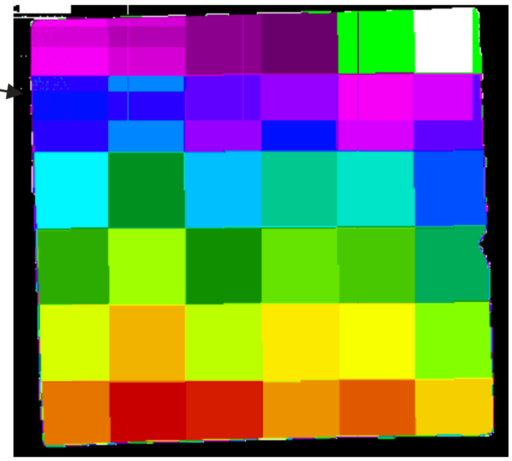
5. Click inside the boundary in the Map Window so it is selected (it will have green hatching on it)



6. Make your colored grids (*.grd file) your active layer
7. On the bottom toolbar, select "Crop Raster to Selected Polygon" Click on "Just this Layer"

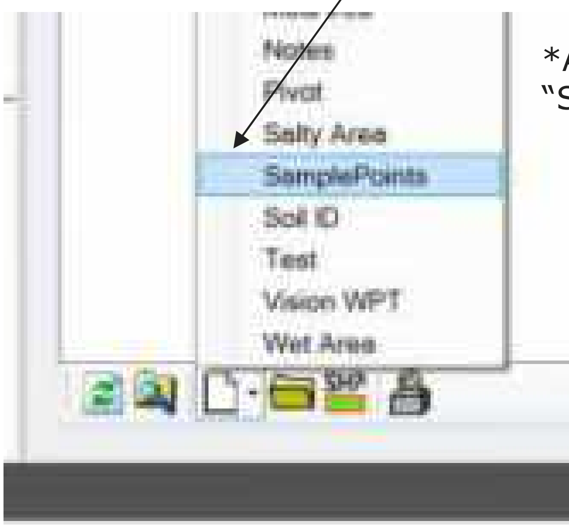
Grid Sampling—Creating Custom Grid Points

8. Click "Save" on the bottom toolbar
9. Your image should now be cropped to the field boundary



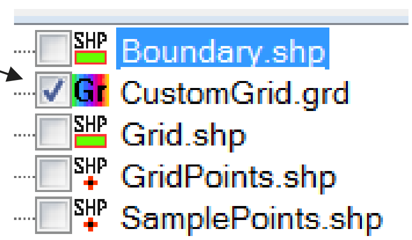
Creating Your Sample Points

1. Click "Clear Map"
2. Under "Templates" on the bottom of layer selection, choose "Sample Points"

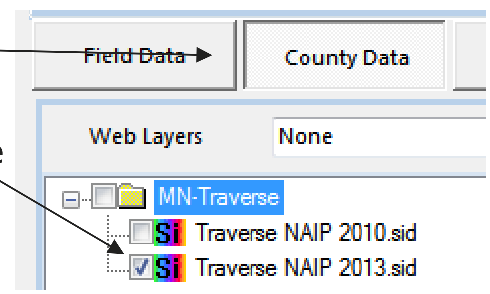


*A new Point Shape File will be created labeled "SamplePoints"

3. Make your colored grid image (*.grd file) your active layer.



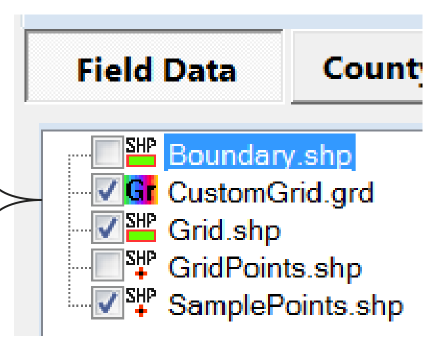
4. Go to the "County Data" button and check on a NAIP image that represents the field you are working on. This will allow you to have a visual image when you are deciding where to drop the new points.



5. Go back to the "Field Data" button.
6. Check on the Grid.shp file
7. Check on the SamplePoints.shp file

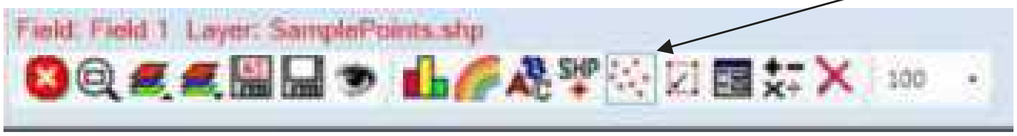
(nothing will appear when SamplePoints.shp is checked on)

This allows you to make a custom grid while remaining in the selected grid size



Grid Sampling—Creating Custom Grid Points

8. With "SamplePoints.shp" as your new active layer, select the "Multi Point Draw Tool" on the bottom toolbar below your map window.



9. Click in the grids in the order in which you would like them sampled. (Start at the first one and go to the last one)

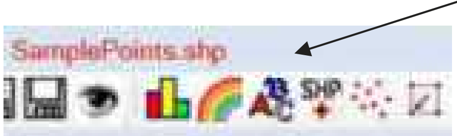
10. When you are finished, de-select the "Multi Point Draw Tool". Your new points will automatically save.

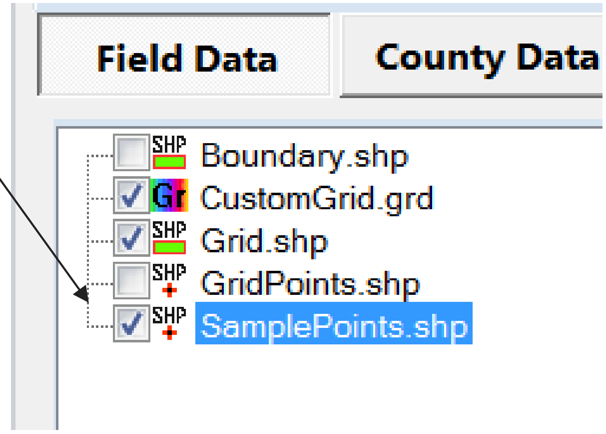
11. You now should have your custom points that look similar to the image below.

Grid Sampling—Creating Custom Grid Points

Labeling Sample Points

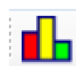
1. Select the sample points file under "Field Data"
2. On the bottom toolbar below the map window, select the labels tool ("ABC" button).

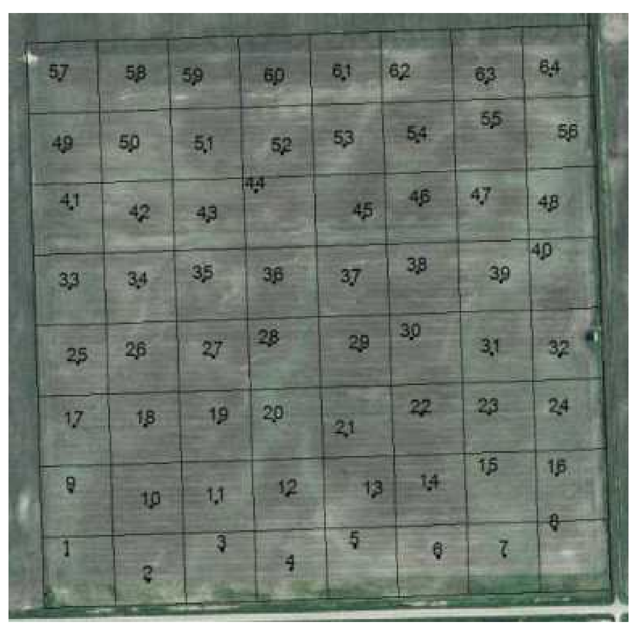




3. Check on "Labels Visible"
4. Select "MPVal" from the source database dropdown
5. Select height (in feet) recommended for field view is 50-100 feet
6. Click **"Apply"**

Changing Point Style

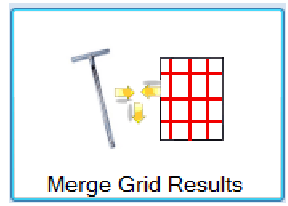
1. Select "Change Draw Style" on the bottom toolbar 
2. Select you Line or Point Color and Fill color
3. Choose the size of the points
    - Fixed Sizing—Stays the same size (3 pixels recommended)
    - Scaled sizing changes when you zoom in and out (16 feet recommended)
4. Click **"Apply"**



- **You will now have a custom grid to go sample with.**
- **See "Using GPS Controls" for in-field GPS use.**

Grid Sampling—Creating Nutrient Layers

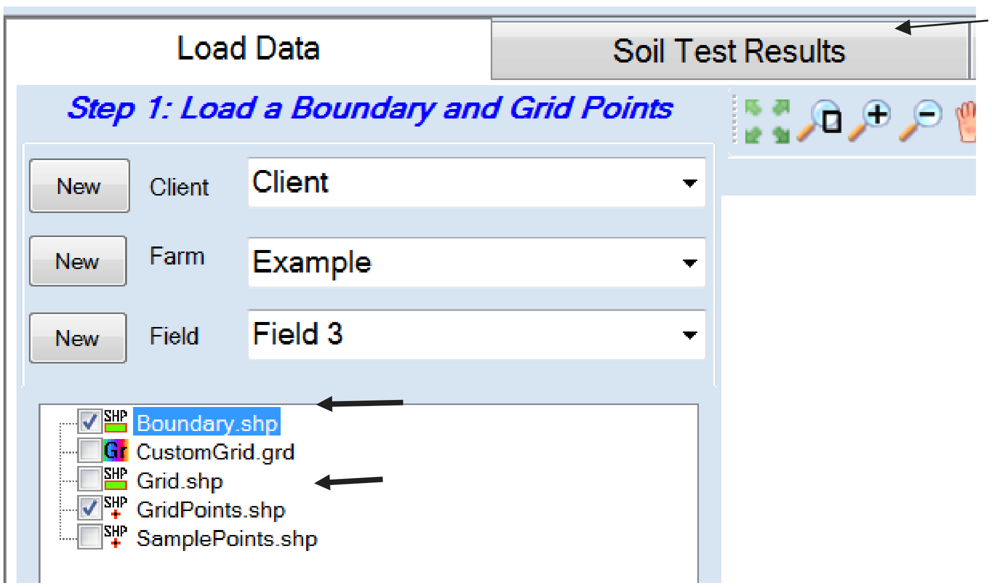
Creating Nutrient Layers



Once you get your soil test results back from the lab, you can now use them to create nutrient maps of the field.

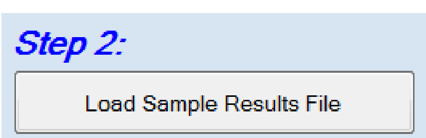
- *This is going to be done in the "Merge Grid Results" window.*

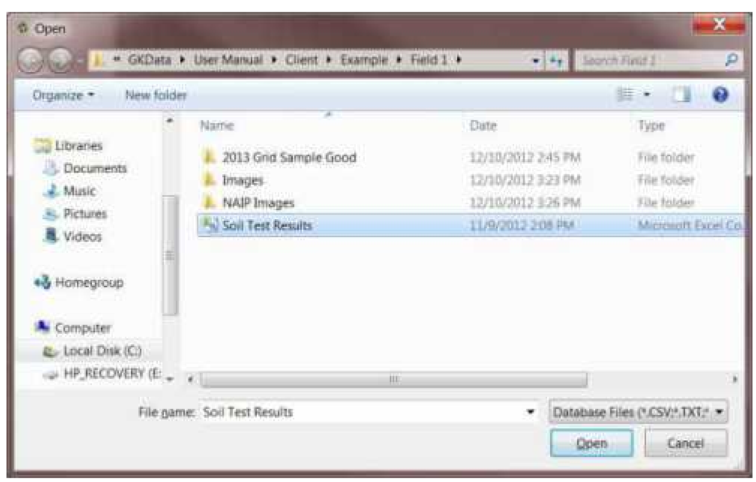
1. Once you are inside the "Merge Grid Results" window, select the appropriate "Client" "Farm" "Field"
2. Select the grid points and boundary files that are associated with the field



3. When the Grid Points are your active layer, switch to the Soil Test Results tab on the top of the screen.

4. Click the "Load Sample Results File" button





This is where you will choose your soil test results file.

Both *.csv and *.xls file formats can be imported.

Make sure you have only one set of results per sheet on excel when loading a *.xls file

Grid Sampling—Creating Nutrient Layers

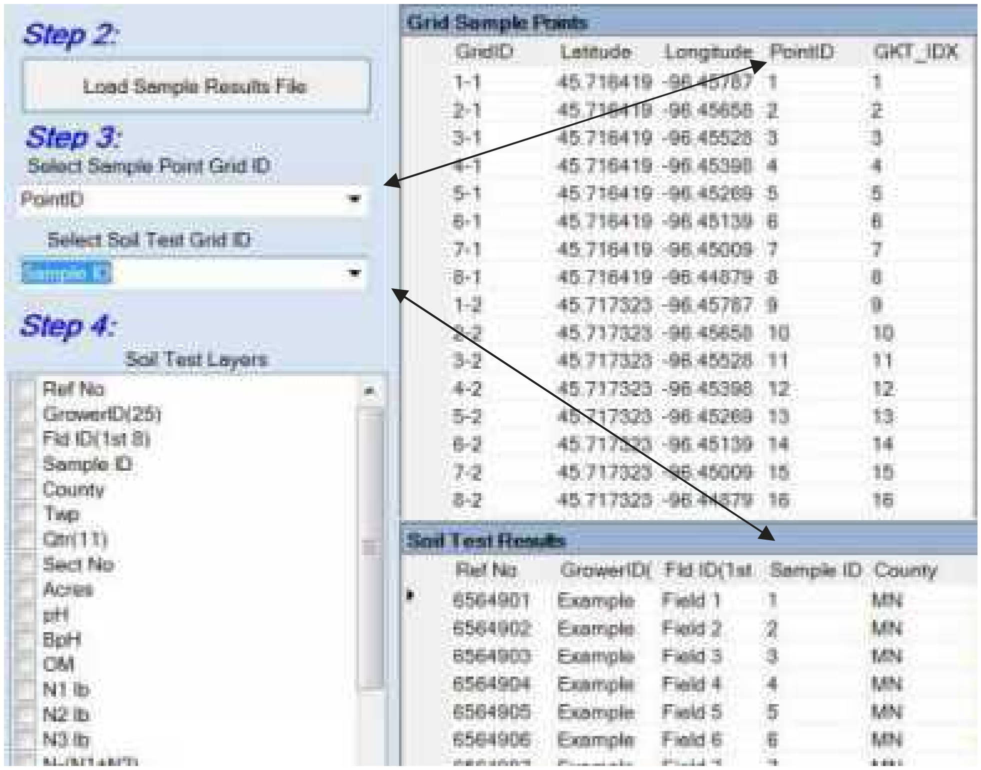
5. ***Step 3:*** Assign Sample Point Grid ID
   (Select Column ID that corresponds to the Field—sample points numbers)
6. ***Step 3:*** Select Soil Test Grid ID
   (Select Column ID on the Soil Test that matches - sample point numbers)

Make sure that the sample results file has the EXACT same numbering system as the points.

You can temporarily change or delete any value or row in the soil test results they will not be changed on the original file.

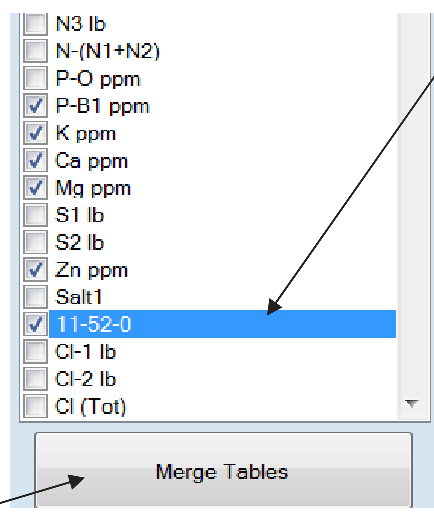
A column with any null values cannot be merged or mapped.

If a value in the sample results is null it can be changed to 0 to merge correctly.



Loading Equations Directly From MS Excel

- You can bring equations directly in from Excel if from recommendations already on the spreadsheets
- Instead of selecting the nutrient, select the column name which contain the equation to create the map for (ex: 11-52-0)
- The software will read the value in the column and not the whole equation



7. Choose which nutrients you want to build maps for. You can select multiple items at once.
8. When all the desired nutrients are selected, click "Merge Tables"

Grid Sampling—Creating Nutrient Layers Phosphorous Conversion

Using CSV / XLS Soil Test Results—Phosphorous Conversion

Soil phosphorous values may be tested and reported in several different ways such as Olsen, Bray, and Mehlich 2 & 3. Do to variables like pH differences some samples may be tested as one type and other samples tested as another. For example a high pH test may have an Olsen result where a lower pH may have a Bray result. ADMS cannot distinguish these differences. So there are some conversion tools to update columns that may have zeros in them, or create a new column if the phosphorous result needs to be a certain type for recommendations or scripts.

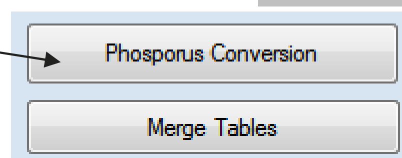
Updating Existing Columns

If there is a column that has only some values reported in it. It can be updated using the other Soil P column. For example these results have three zones reported as Olsen Values and only one zone reported as a Bray value.

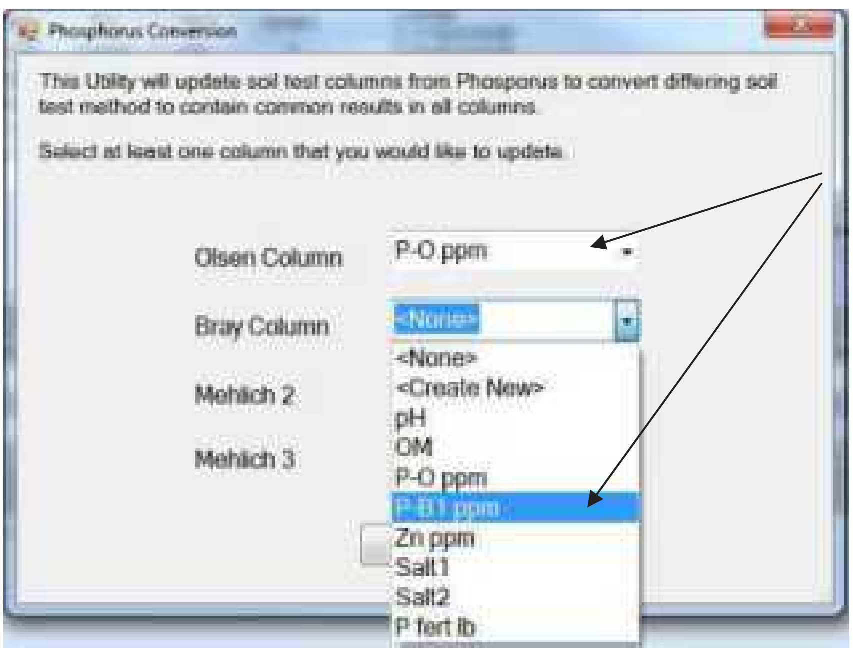
P-O ppm	P-B1 ppm
9	0
7	13.3
6	0

To report everything in P-B1 a conversion must be ran before the maps are created.

1. Click on the “Phosphorous Conversion” button.



The “Phosphorous Conversion” window will appear.



If the columns have values in them they will show up as a dropdown option.

2. Choose the corresponding columns.
3. To update values two columns must be filled in. ADMS will use the values in one column to convert to the other value. In this example the Olsen values will be converted to Bray (P-B1).
4. After the dropdowns are filled in click “Run Conversion.”

5. After clicking “Run Conversion” the missing values will be updated.

P-O ppm	P-B1 ppm
9	14
7	13
6	9

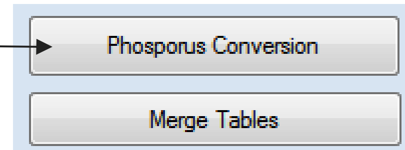
Grid Sampling—Creating Nutrient Layers Phosphorous Conversion

Using CSV / XLS Soil Test Results—Phosphorous Conversion

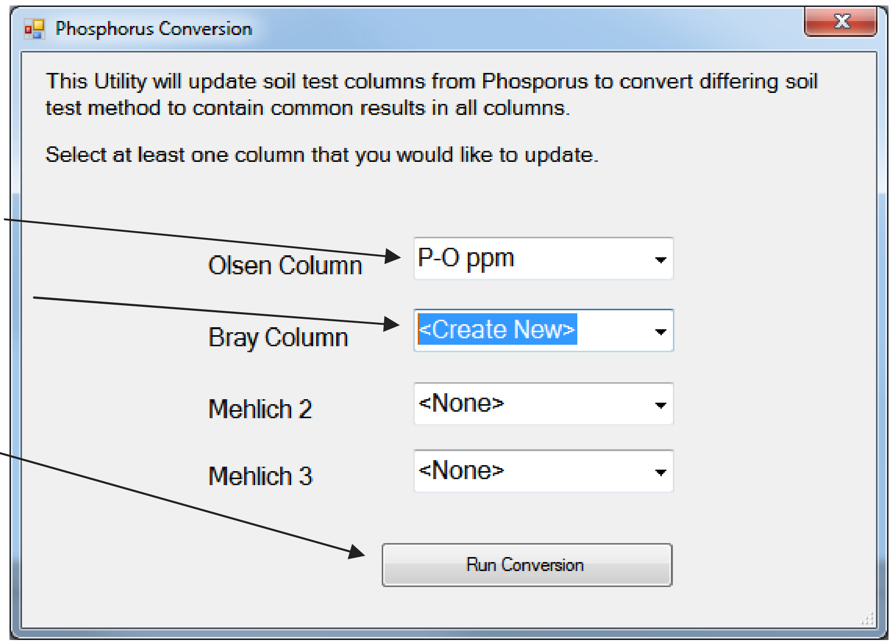
Creating New Columns

If soil test results are reported as one value, but they need to be converted to used in recommendations or scripts it can be done using the same tool. Instead of updating an existing column it will create a new one based on existing values.

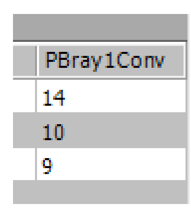
1. Click on the “Phosphorous Conversion” button.



2. The “Phosphorous Conversion” window will open.
3. Select the existing Soil Phosphorous column from the dropdown.
4. Select “<Create New>“ for the soil test value that needs to be converted.
5. Click “Run Conversion.”

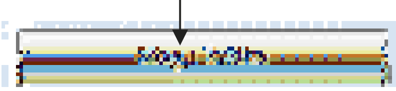


After the phosphorous conversion has run it will create a new column of the converted soil test values. And can be merged with the sample points.



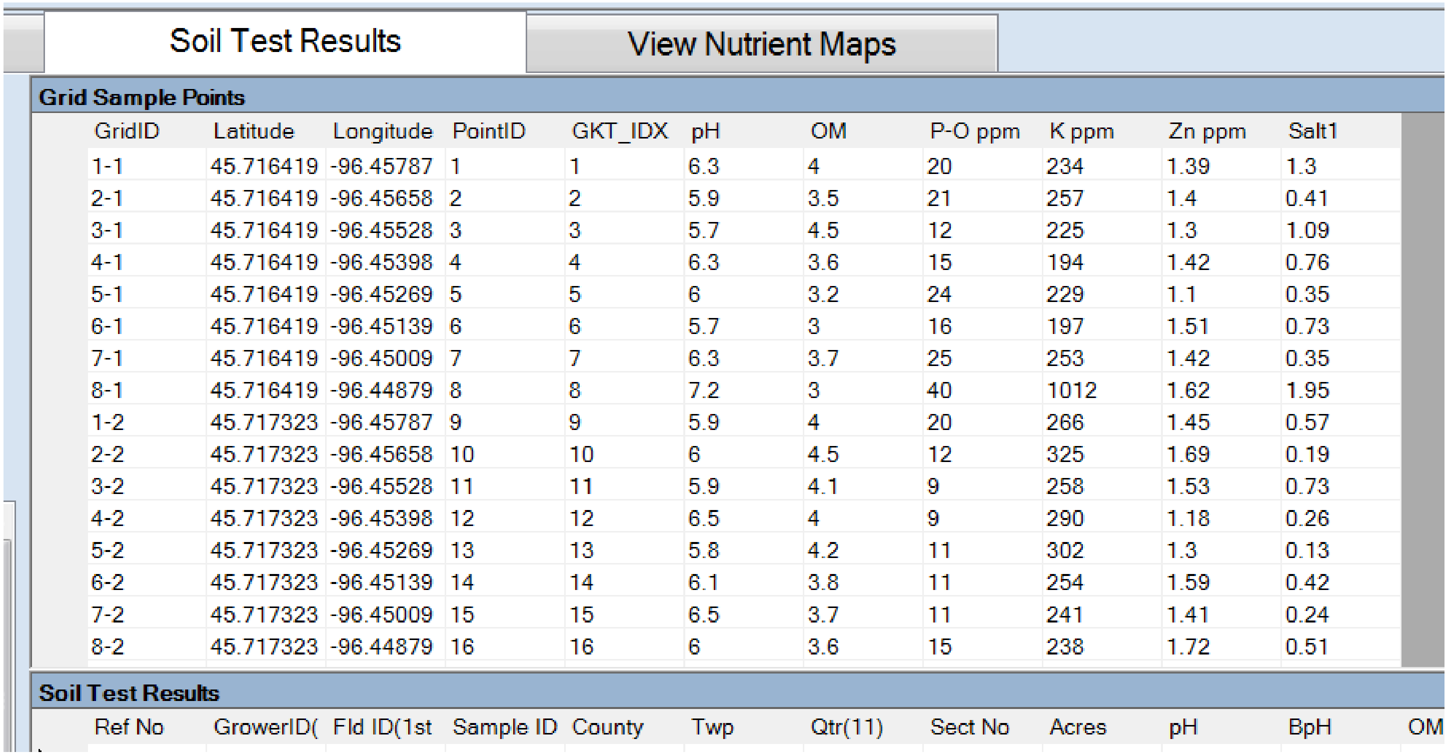
Nutrient layers can be built off of these the same as any other column.

Click “Merge Tables” to merge with the sample points.



Grid Sampling—Creating Nutrient Layers

- The soil test results will now merge with the grid sample points file.



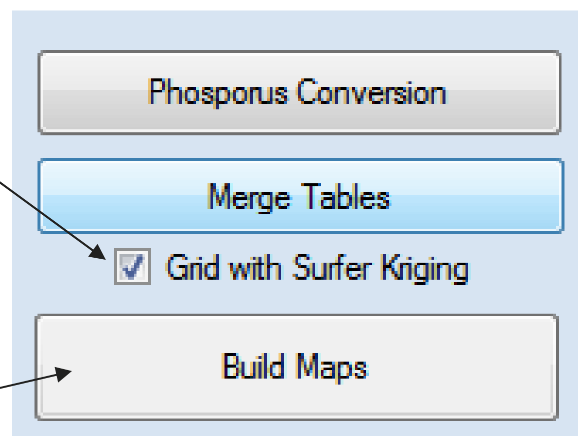
GridID	Latitude	Longitude	PointID	GKT_IDX	pH	OM	P-O ppm	K ppm	Zn ppm	Salt1
1-1	45.716419	-96.45787	1	1	6.3	4	20	234	1.39	1.3
2-1	45.716419	-96.45658	2	2	5.9	3.5	21	257	1.4	0.41
3-1	45.716419	-96.45528	3	3	5.7	4.5	12	225	1.3	1.09
4-1	45.716419	-96.45398	4	4	6.3	3.6	15	194	1.42	0.76
5-1	45.716419	-96.45269	5	5	6	3.2	24	229	1.1	0.35
6-1	45.716419	-96.45139	6	6	5.7	3	16	197	1.51	0.73
7-1	45.716419	-96.45009	7	7	6.3	3.7	25	253	1.42	0.35
8-1	45.716419	-96.44879	8	8	7.2	3	40	1012	1.62	1.95
1-2	45.717323	-96.45787	9	9	5.9	4	20	266	1.45	0.57
2-2	45.717323	-96.45658	10	10	6	4.5	12	325	1.69	0.19
3-2	45.717323	-96.45528	11	11	5.9	4.1	9	258	1.53	0.73
4-2	45.717323	-96.45398	12	12	6.5	4	9	290	1.18	0.26
5-2	45.717323	-96.45269	13	13	5.8	4.2	11	302	1.3	0.13
6-2	45.717323	-96.45139	14	14	6.1	3.8	11	254	1.59	0.42
7-2	45.717323	-96.45009	15	15	6.5	3.7	11	241	1.41	0.24
8-2	45.717323	-96.44879	16	16	6	3.6	15	238	1.72	0.51

Soil Test Results

Ref No	GrowerID(	Fld ID(1st	Sample ID	County	Twp	Qtr(11)	Sect No	Acres	pH	BpH	OM

9.After the two tables are merged, you can choose to "Grid with Surfer Kriging" (**This is optional.** If you are going to use Kriging, you must have the demo version of Surfer 8 installed)

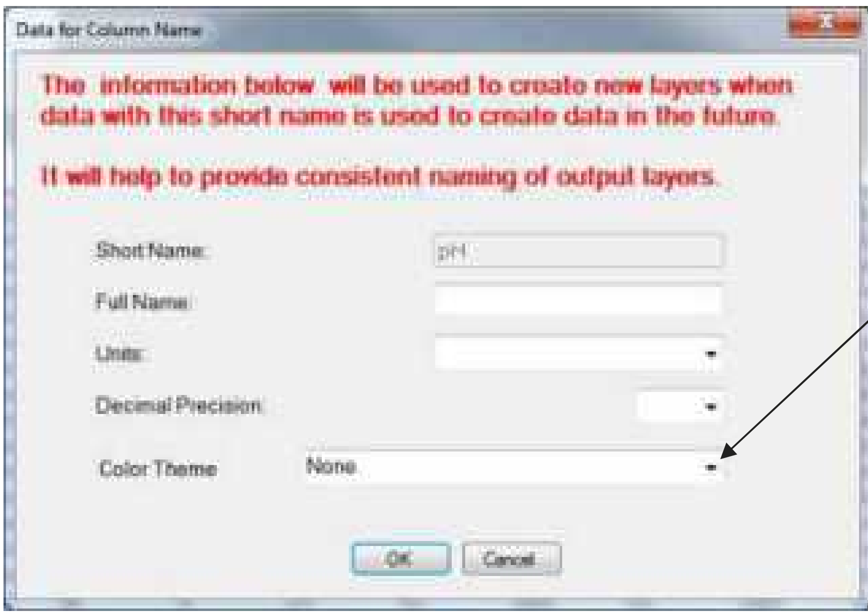
The software by default will use inverse distance you DO NOT need surfer to do this and leave the box unchecked.



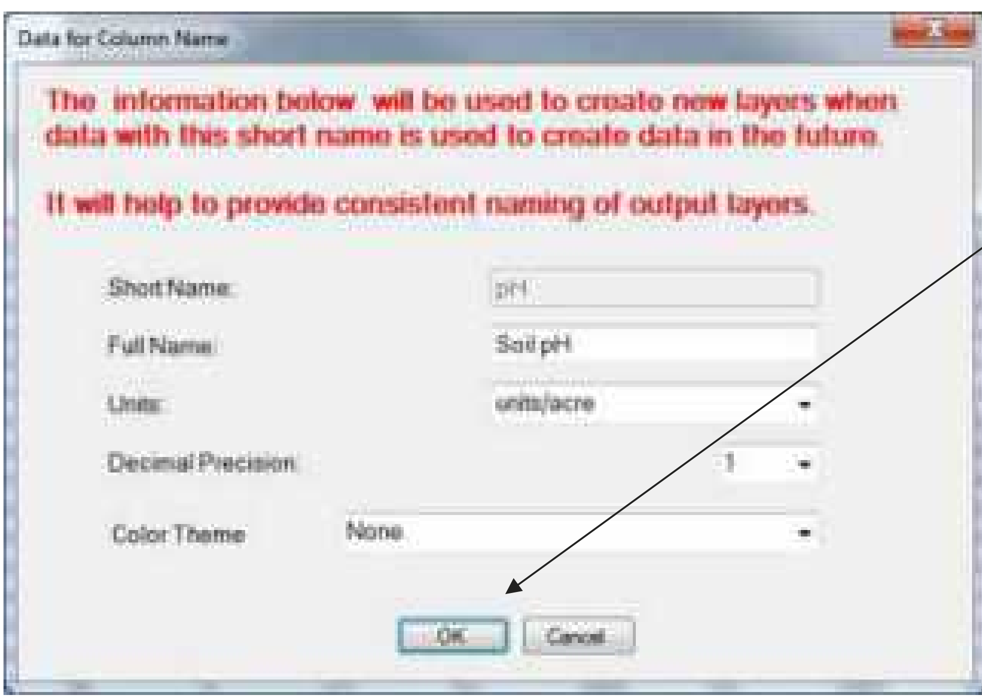
10.Select "Build Maps"

Grid Sampling—Creating Nutrient Layers (Common Name Mapping)

- If this is the first time you have done this, you will be asked to assign a name to your nutrient. This is so that all nutrient output maps share a common name among all of the fields you load test results for.
- DO NOT use the field name as part of your name
- Make sure and fill in all the boxes (Full Name, Units, and Decimal Precision)
- These names will stay this way. This keeps them the same when you are using scripting to write the prescription



- A default color theme may also be applied. Refer to that section of the book for more explanation.

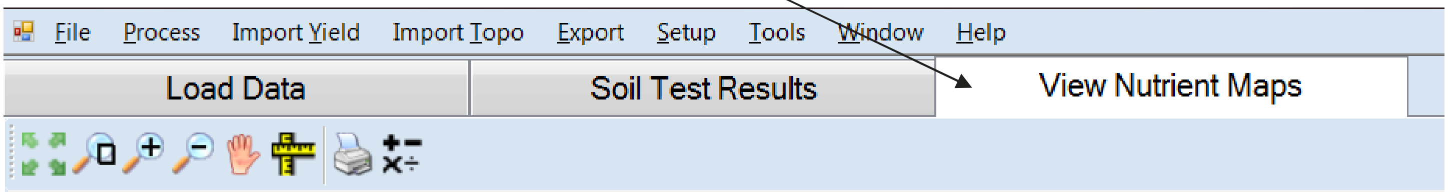


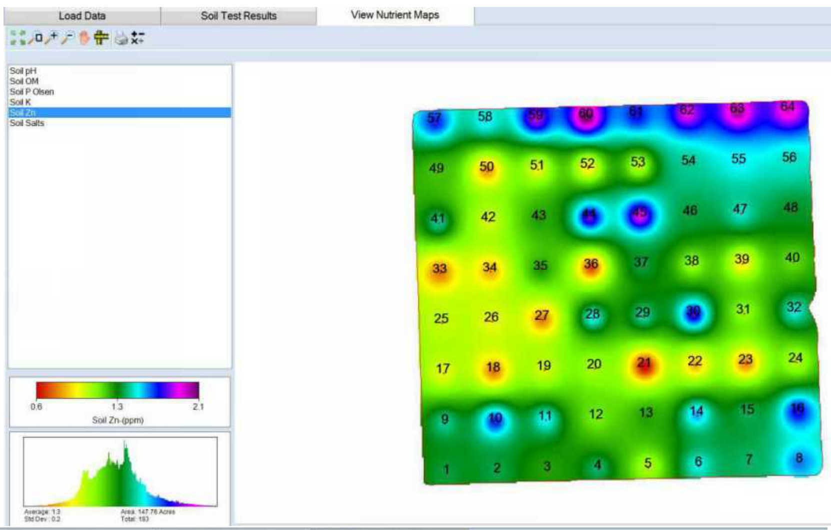
11. Once you have a name, units, and decimal precision assigned, click "OK" and go on to the next one.

- Do this until the Data for Column Name boxes stop appearing.

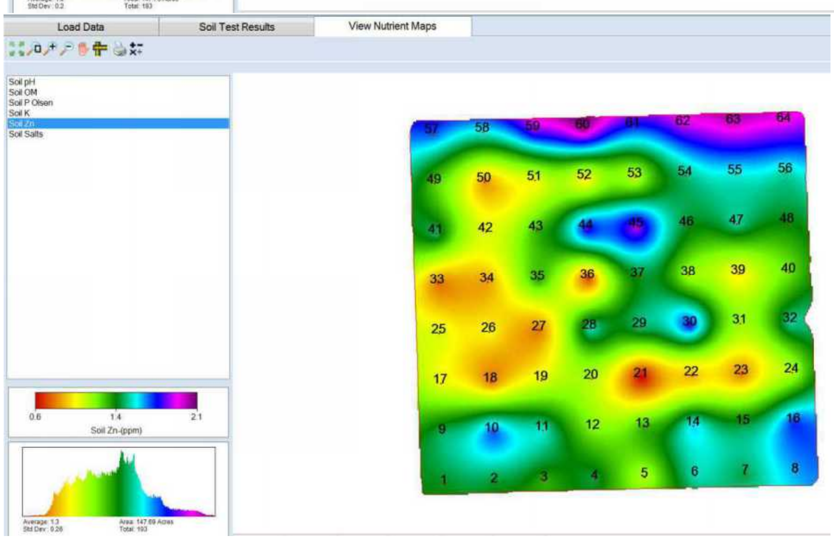
Grid Sampling—Creating Nutrient Layers (Inverse Distance & Kriging)

12. Select the "View Nutrient Maps" Tab on the top of the screen. You can now view your created nutrient maps for the field.

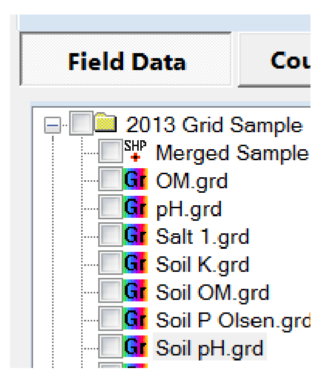




- **Created With ADMS Inverse Distance**

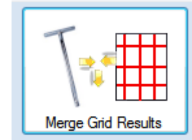


- **Created With Surfer Kriging**



- The newly created nutrient layers will be stored under ***"The Year" Grid Sample*** folder under "Field Data"
- You can change the year of the output folder: Go to Tools/ Settings/User Interface 2 and change the current season

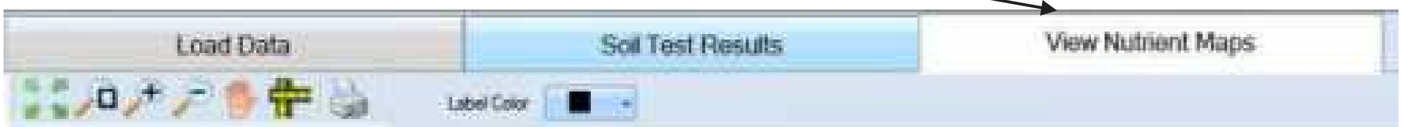
Grid Sampling—Printing Grid Nutrient Layers



Starting at version 6.4.1, there is an option within the software that allows printing of the nutrient surfaces while automatically changing the labels on the sample points to correspond with the nutrient maps.

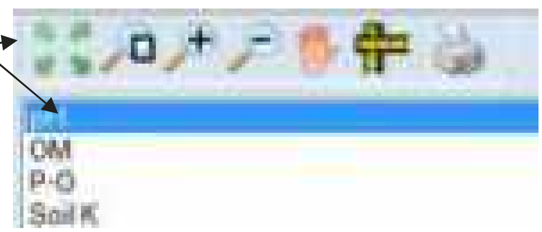
After following the steps to build nutrient maps, stay in the Merge Grid Results window.

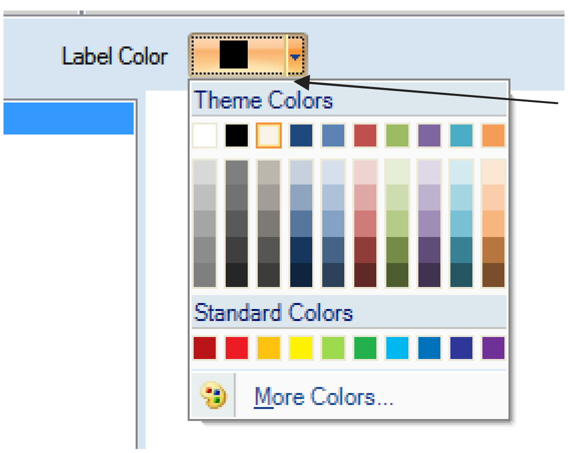
1. Go to the "View Nutrient Maps" tab.



2. The nutrient maps will be displayed in the window. The labels will be automatically turned on to correspond with the correct nutrients. If they are not visible, click on one of the nutrient maps on the left side of the window.

3. If the map does not fill the entire window click:
"Zoom to Extents."



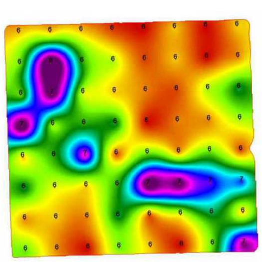


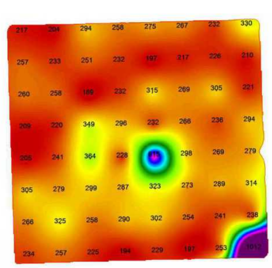
4. Before printing, there is an option to change the label colors if desired.

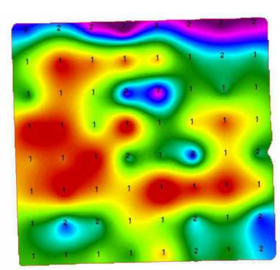
**Note this will change all of the labels to the selected color*

5. After the desired label color has been selected click the print button on the top toolbar.

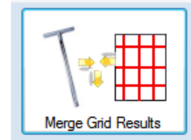
The maps will print with the correct labels for each nutrient.





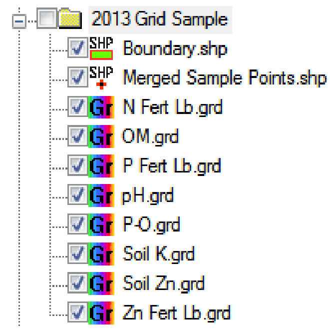


Grid Sampling—Printing Grid Nutrient Layers

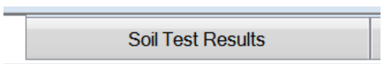


If existing nutrient maps exist with a merged sample points file, this same printing function can be used.

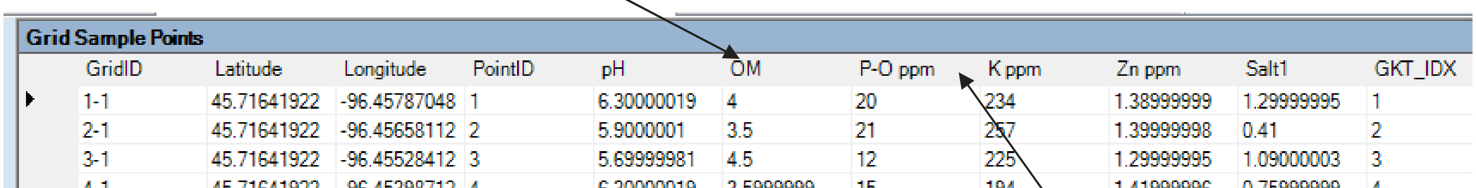
1. Open "Merge Grid Results."
2. Under the "Load Data" tab select:
   - Boundary
   - Merged Sample Points
   - Nutrient layers that will be printed



3. After these layers are all turned on, go to the "Soil Test Results" tab.



4. The merged sample points will automatically be visible at the top of the window under "Grid Sample Points". The nutrient columns should be visible.

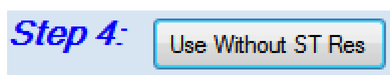


Grid Sample Points

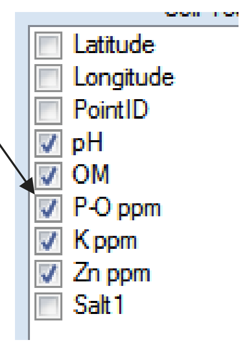
GridID	Latitude	Longitude	PointID	pH	OM	P-O ppm	K ppm	Zn ppm	Salt1	GKT_IDX
1-1	45.71641922	-96.45787048	1	6.30000019	4	20	234	1.38999999	1.29999995	1
2-1	45.71641922	-96.45658112	2	5.9000001	3.5	21	257	1.39999998	0.41	2
3-1	45.71641922	-96.45528412	3	5.69999981	4.5	12	225	1.29999995	1.09000003	3
4-1	45.71641922	-96.45398712	4	6.30000019	3.5999999	15	194	1.41999996	0.75999999	4

5. Proceed to **Step 4:**

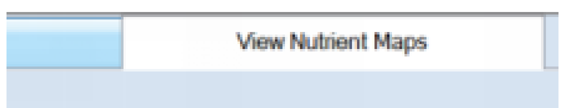
   - Click "Use Without ST Results."



6. Under Soil Test layers, the nutrient maps that were turned on will automatically have a check mark in front of them.

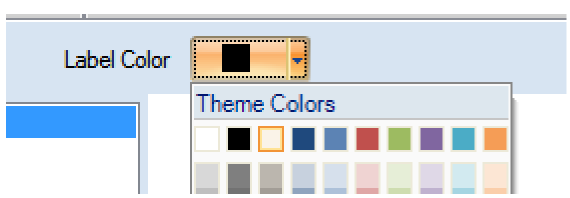


7. Select "View Nutrient Maps."



8. The maps will now be visible with the correct sample points turned on.

9. Change the label color if desired.



10. Select the print icon at the top toolbar to batch print all the surfaces turned on.

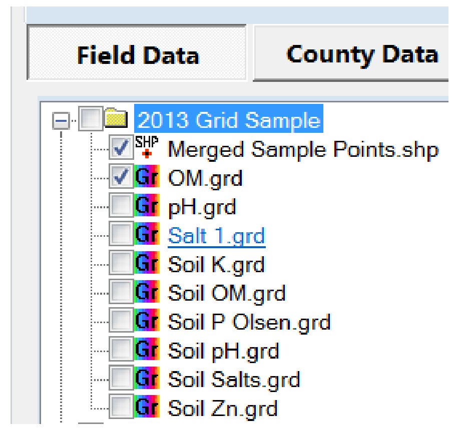
Grid Sampling—Printing Grid Nutrient Layers

You should now have all the components you need from your soil test results; your nutrient maps, your boundaries, and depending on the prescription you are going to be using, you may want to have a yield goal map. Refer to that section in the book on how to create that map. You can now print your maps, be ready for the prescription writing process.

Printing Soil Test Result Maps

- Nutrient maps can be printed and overlaid with the corresponding grid points and the soil test results
- This has to be done individually for each nutrient map

1. Go to the Grid Sample File
2. Check the nutrient *.grd file (ex: OM)
3. Select "Merged Sample Points"

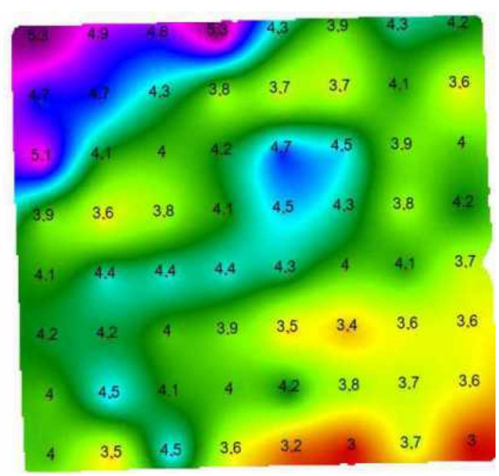


4. Select the "ABC" change label tool on the bottom toolbar below the map window

5. Make sure labels are visible

6. Select the corresponding nutrient out of "Source Database Column"

7. Click "Apply"



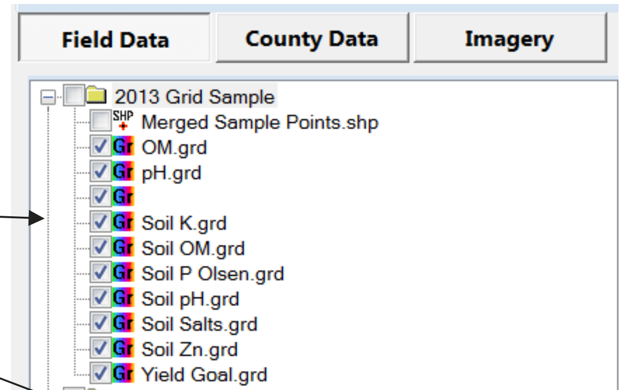
- The point labels should now be the same as the test results.
- This can now be printed.
- Repeat from the top of the page as needed for the desired nutrients

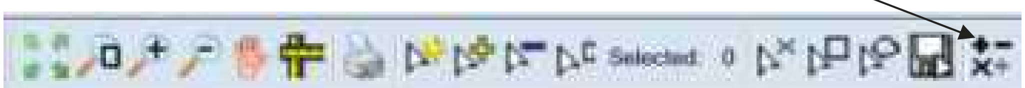
Grid Sampling—Using Scripting To Write Prescriptions

Writing a Prescription From Nutrient Maps Using Scripting

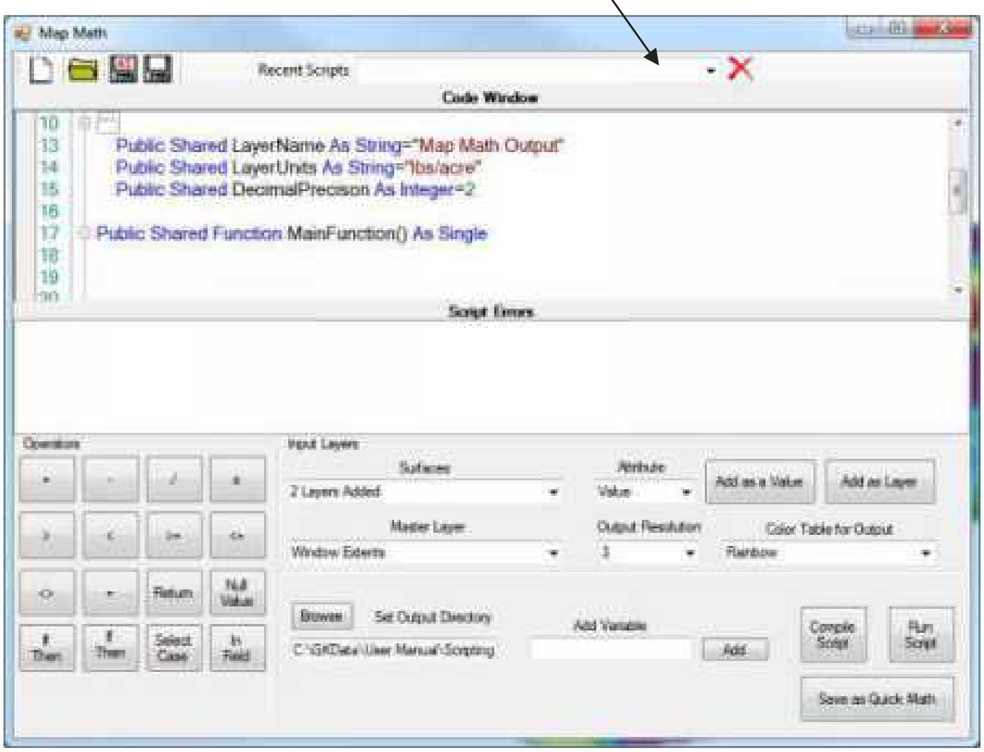
Once you have all of the desired nutrient maps created, you are ready to create the fertilizer prescription using the scripting method. You can use an existing prescription or create your own by following the instructions in the ***Getting Started With Map Math*** Section.

1. Under Layer Info, select Clear Map so there are no loaded layers in the map widow. 
2. Select all the input layers that will be used to create the prescription.
3. On the top toolbar, select the “Multi Layer Map Math” button



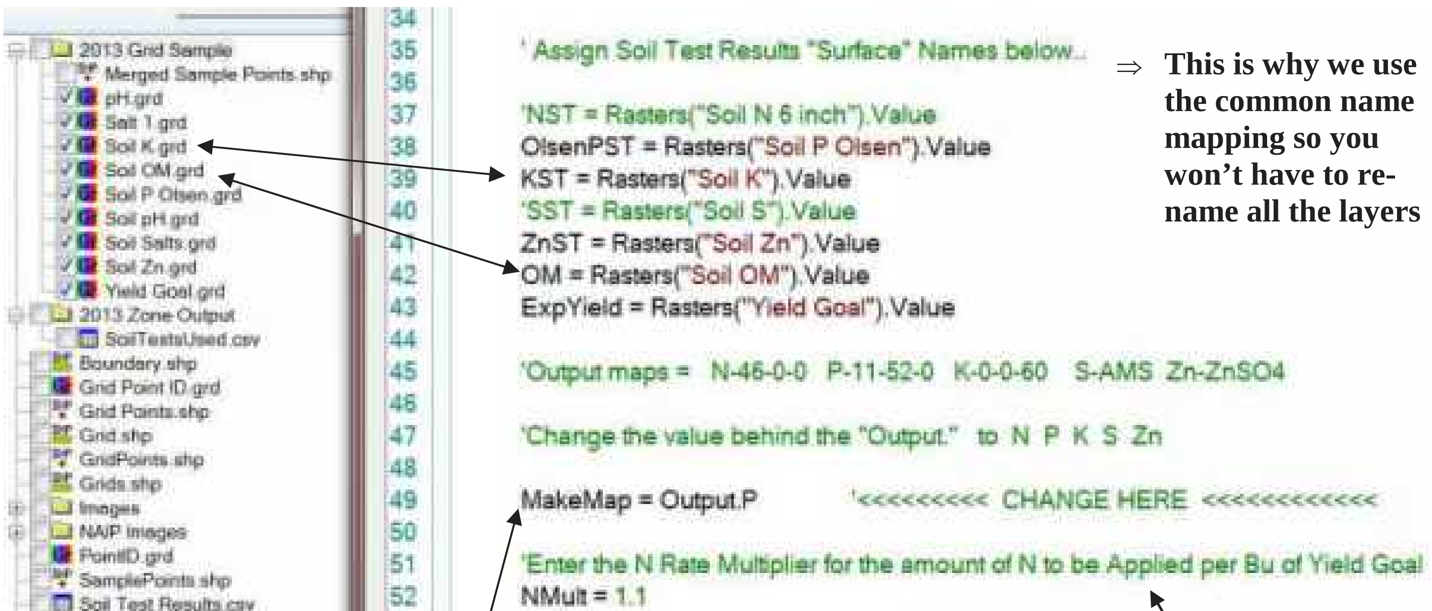


4. Load the script that you wish to use. If you have used some recently, they will be in the “Recent Scripts” dropdown.
5. If you are going to load a new script, select the folder icon 



Grid Sampling—Using Scripts To Write Prescriptions

6. Now is the point where you change values, select your input maps, give additional nutrient credits, and select the product output map. Each script may be slightly or completely different. For this, the Corn NPKSZ AgviseBroadcast script will be used.
7. Scroll down in the Map Math window until you get to the spot where you assign surface names.
8. Make sure the a names in red are the same as the nutrient layers in your data tree.
9. If you do not have one of the test results, you can use the apostrophe in front of the name to comment it out. You can see this in Green (ex: ‘NST=Rasters(“Soil N 6 inch”).Value)
10. Make sure these are not required for the product calculations!



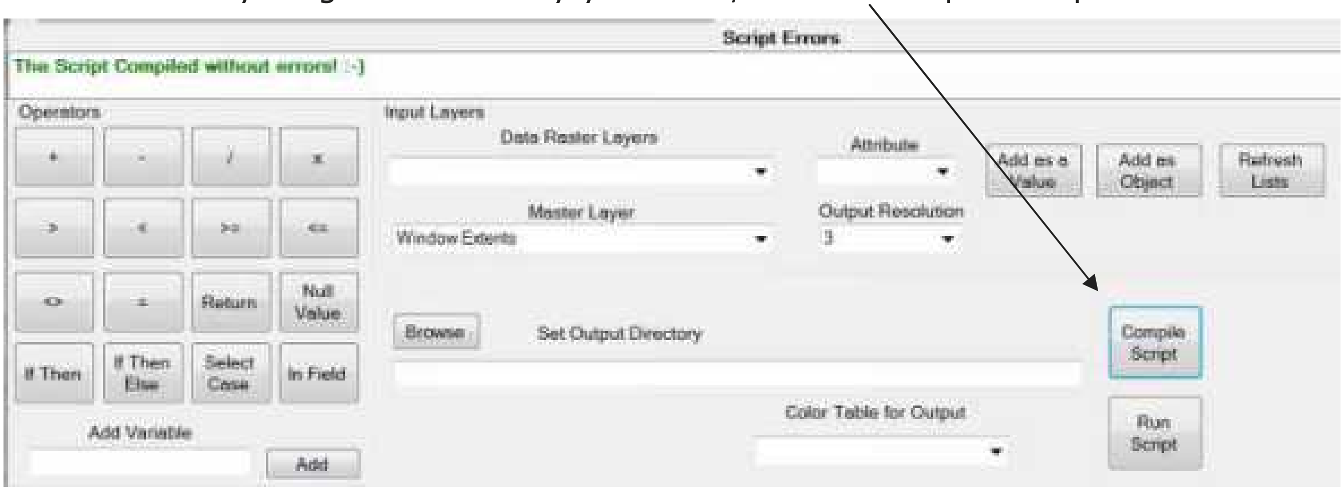
⇒ **This is why we use the common name mapping so you won’t have to re-name all the layers**

10. Select the output map to make (ex: Output.P). This will make 11-52-0 product map
11. Enter the N rate Multiplier (ex: 1.1)
12. Scroll down to select any additional credits and Min and Max Values to be applied.

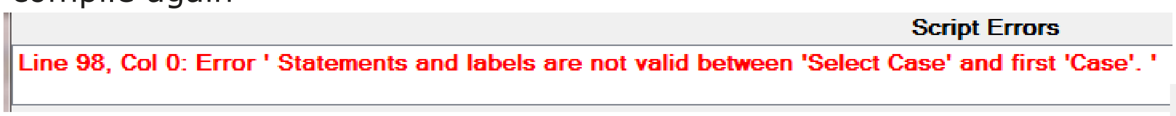
```
'Values above the BRK number will return the Minimum, Values below BRK will return a 0
MaxN = 400
MinN = 40
MinBRKN = 10

MaxP = 300
MinP = 40
MinBRKP = 10
```

Grid Sampling—Using Scripts To Write Prescriptions

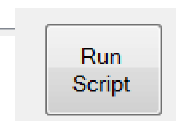
13. Once everything looks the way you want, select "Compile Script"

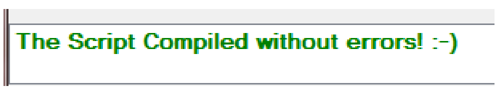


14. If there are errors in the script, it will show under script errors, fix any errors, and compile again



15. Once you see there are no errors in the script, click "Run Script"



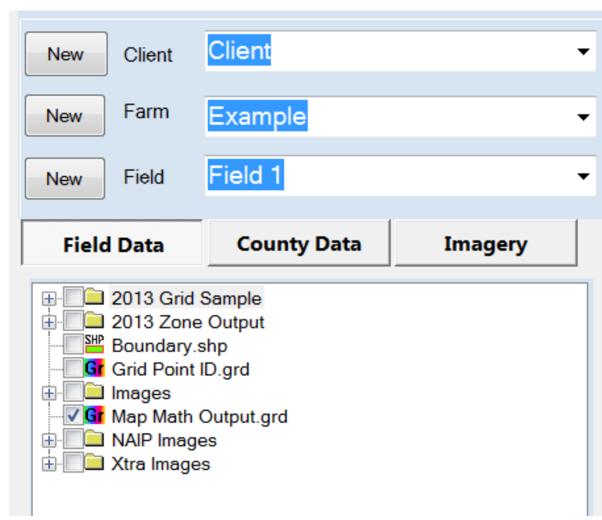


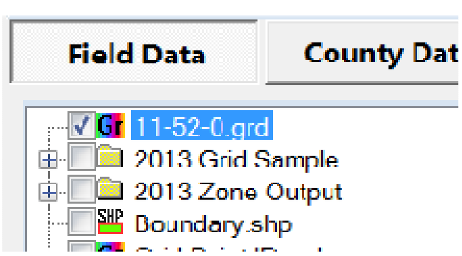
16. You should now have a layer called "Map Math Output". This is the 11-52-0 product map

17. Click "Save As" on the bottom toolbar 

18. Save this map as 11-52-0

19. Make sure and rename each product map. If you leave it as "Map Math Output" it will be replaced each time you run the script and create a new product.





20. This process can now be repeated for all of the products you wish to apply.

21. After the maps are built, follow the instructions on the *Exporting Prescriptions* Section. This gives you step-by-step instructions for each type of controller.

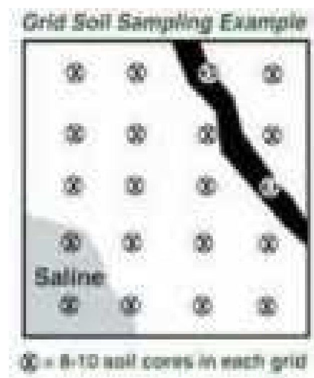
Grid Sampling—Sampling Methods

Grid Sampling Methods

When soil sampling, it is important to make sure you take an accurate representation of the field. Here are some general guidelines to follow when out sampling.

Credit for this information is from Agvise Laboratories: http://www.agviselabs.com/soil2.php, and The University of Nebraska Lincoln (UNL): http://cropwatch.unl.edu/web/ssm/soilsampling

Grid Soil Sampling: Grid soil sampling involves dividing whole fields into small equal sized areas or grids (1-5 acres) (see example). The soil cores from each grid are collected either from the center point of the grid or from random cores within the grid. A minimum of 8-10 cores from each grid is required to provide enough soil for all laboratory analysis to be completed.



Sample Handling - Soil Fertility Analysis

Proper soil sample handling procedures depend on which nutrient analysis is requested. Soil samples that will be analyzed for nitrate-N should be kept cool or shipped to the laboratory immediately. If samples are stored in a warm area for extended periods of time, the nitrate level in the sample will increase. Warm temperatures during shipping or storage increase the activity of microbes in the soil sample. This microbial activity causes the release of additional nitrate-N in the soil sample bag. If this happens, the laboratory analysis for nitrogen will be incorrectly high, due to improper sample handling.

Soil samples that will be analyzed for all other nutrients are not affected by temperature and do not need special handling.

Credit for the above information is given to Agvise Laboratories: http://www.agviselabs.com/soil2.php

Grid Sampling

A well-done nutrient map derived from a grid sample can be a valuable resource for many years. Consequently, the density should be adequate to provide confidence in the accuracy of the maps developed from the data. We suggest analyzing one sample per acre, which is composited from five cores collected in a tight radius about the sample point (Figure 3). This density will result in a map that will be good for many years —10 to 20 years for soil organic matter and cation exchange capacity; five to ten years for pH; and four to five years for phosphorus, potassium and zinc. On fields in which variability is expected to be low, a sampling density of two to two-and-one-half acres per sample may be acceptable. Grid sampling at densities coarser than one sample for every 2.5 acres is not recommended, if the goal is to develop a resource of nutrient maps that can be used with confidence over several years.

Credit for the above information is given to UNL: http://cropwatch.unl.edu/web/ssm/soilsampling

Grid Sampling—Sampling Methods

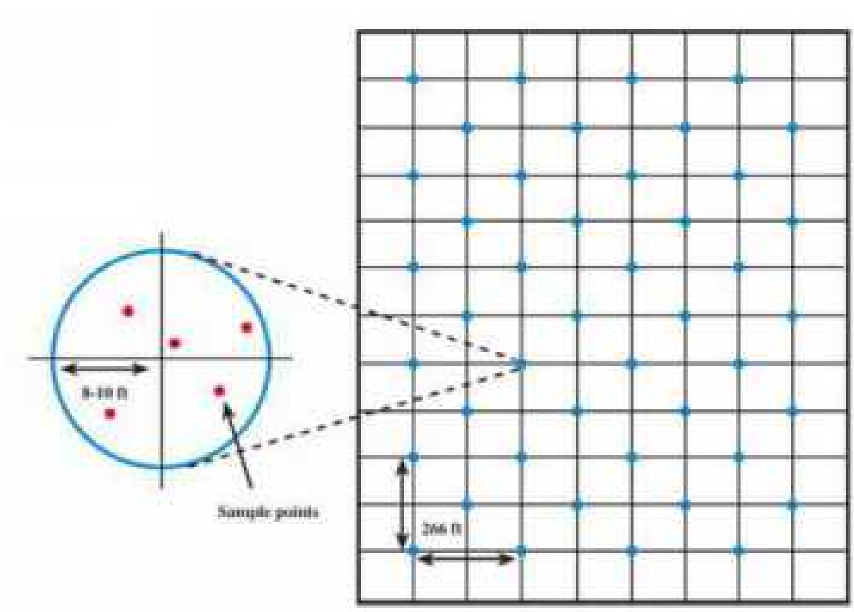
Sampling Pattern and Depth

An offset grid pattern is recommended as shown in the figure below. This will provide more information at a lower cost than a regular grid pattern. Individual cores should be collected in a radius of 8-10 feet of the grid point, to a depth of 8 inches. The grid point should represent the central position of a composited sample. Collect samples within the 8-10 foot radius randomly, in order to avoid systematic patterns such as starter or preplant bands. Conduct a general fertility analysis on the samples, including soil organic matter, pH, phosphorus, potassium and other nutrients of interest.

Frequency

As already mentioned, a nutrient map derived from a grid-sampled field can last a long time. If variable rate application of fertilizer or lime occurs, this will have the potential to change nutrient levels or soil pH over time. Soil phosphorus levels will not change drastically with single variable rate applications. We suggest that grid samples be collected every five years for phosphorus. Lime application according to recommendations should amend soil pH for 8-10 years. Even if variable rate lime application has occurred according to a grid-sampled map of pH, it should not be necessary to grid sample for soil pH for 8-10years after application.

Residual Nitrate Sampling. Grid sampling for nitrate-N is not recommended because annual fluctuations in nitrate levels would require annual grid sampling, which is not cost effective for most crops with current fertilizer prices. Instead, residual nitrate sampling (to a depth of 3 feet) should be done on a directed sampling basis.



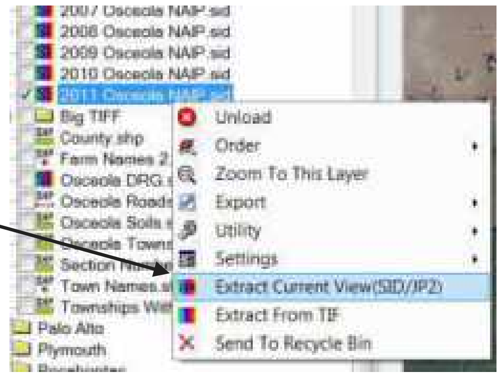
Credit for the above information is given to UNL: http://cropwatch.unl.edu/web/ssm/soilsampling

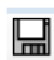
My Notes

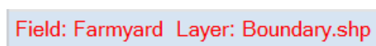
Making A Test Prescription

If you are creating prescription maps that are for seeding or fertilizer, it is always a good idea to create a test map. This will allow you to make sure that everything is working properly before it is time to be in the field. Often the best place to do this is right in your farmyard or by your shop where the equipment is located.

1. Locate your farm on a county NAIP image.
2. Right click on the .sid file you have turned on.
3. Select "Extract Current View (SID/JP2)
4. Select "Save" this will save it to "Field Data" and will by in "Images\NAIP."

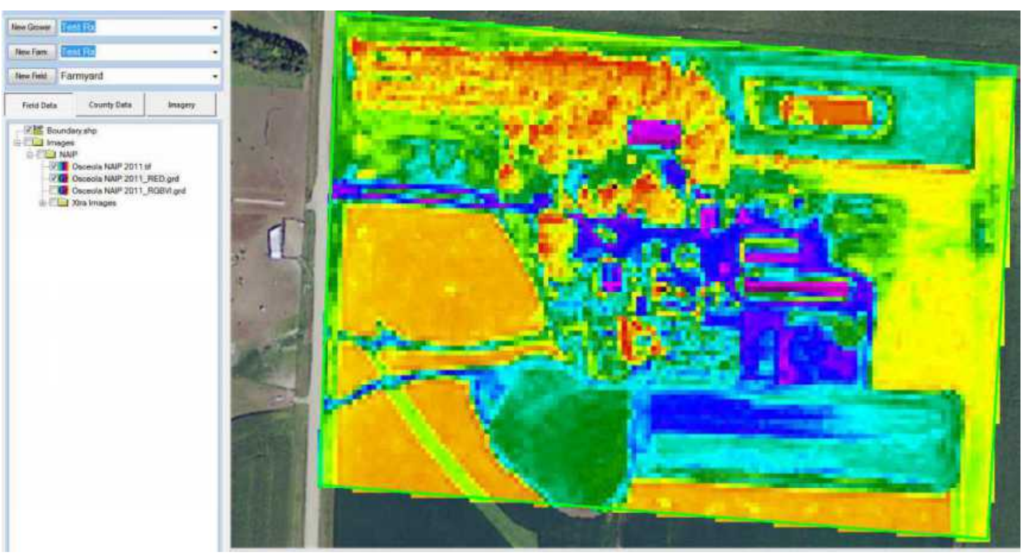


5. Draw a boundary around the test area. (Refer to: *Creating Zones From Boundaries*)
6. Once the boundary is drawn, "Save Changes" 
7. With boundary as the active layer, select inside so the green hatching appears.
8. Under "Field Data", make the NAIP image the active layer.



9. The bottom toolbar will change to display the "SNG" and "VI" buttons. 

10. For most NAIP images select the "RED" under SNG or "RGB VI" under the VI button. If the image has an NIR band it can be selected instead under the SNG button.

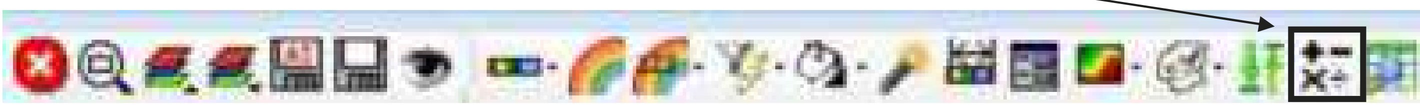


11. This map will now be used as the test prescription.

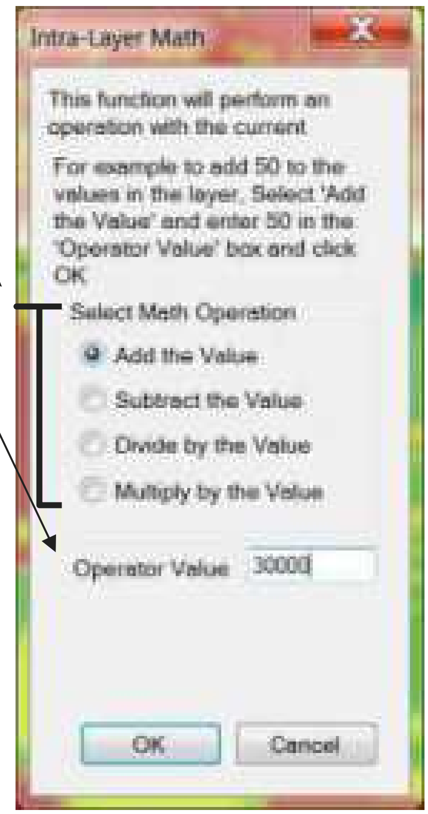
- Rates will be imputed into it to represent the product that is going to be applied.
- This will be exported as a prescription to the controller that will be applying the product.

Making A Test Prescription

To quickly modify the values of the test prescription, a function called Intra-Layer Math can be utilized with the extracted NAIP (*.grd file) that will be used as the test prescription; it is found on the bottom toolbar.



This function can be used to quickly add, subtract, multiply, or divide all of the values in the map. This allows for quick value changes to get as close as possible to represent the actual rates that will be applied in the field.



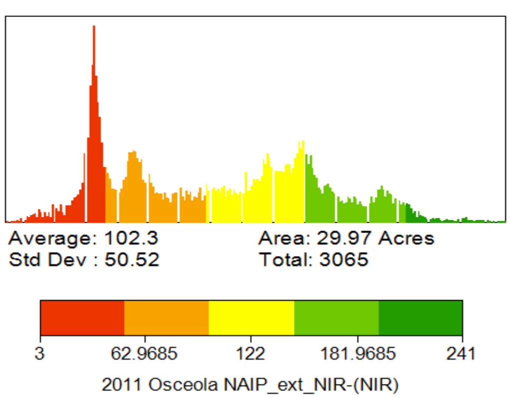
This example will be for a corn seed prescription map.

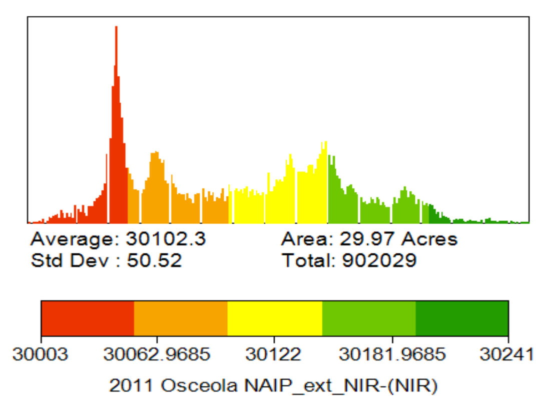
1. With the *.grd file as the active layer, select the Intra-Layer Math button on the bottom toolbar.

2. A window will appear to:
   - Select A Math Operation
   - Choose the value you will be using for the math operation.

3. This example will at the value of 30,000 to every pixel in the map.
4. Click "OK"

All of the map values will change with the statistics and the histogram remaining the same.
Since this is not an in-field situation, it is only important to get close to the rates that are gong to be applied. The goal here is to get something you can test the controller with to make sure everything is working properly before heading to the field.



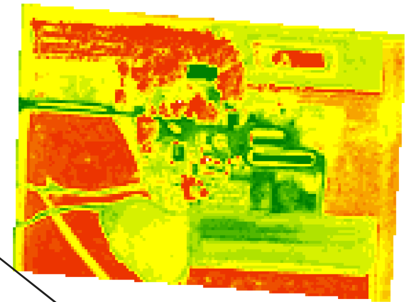


- There are other ways of creating test prescription maps. Refer to the Nutrient Layers section of the book and Creating Prescription Maps—Manually. These outline how to enter in target rates based on each zone.

Making A Test Prescription

Using a mod area to add a zero rate.

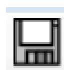
A mod area can be used to add additional rates into the map such as a zero rate. This will give you more control to see what is happening at a specific location in the yard. It is done the same as a test strip.



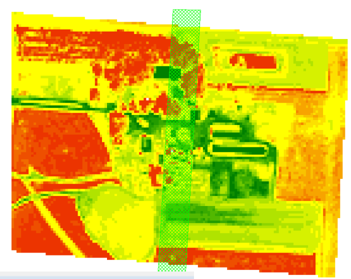
1. Create a new layer from template. This is located at the bottom of the "Field Data" tab.
2. Once ModArea is selected, make sure it is checked on and it is the active layer. Field: Farmyard Layer: ModArea.shp

3. On the bottom toolbar, select the "Draw a New Object" icon.

4. On the map, draw the area where the new rate is going to be.
   - Left click to drop a point, right click to close the polygon.

5. When ModArea is completed, "Save Changes." 

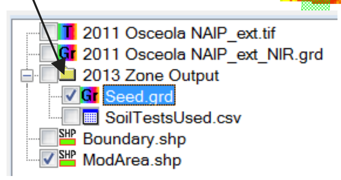
6. With the ModArea as the active layer, click inside the polygon on the map window so it turns green.



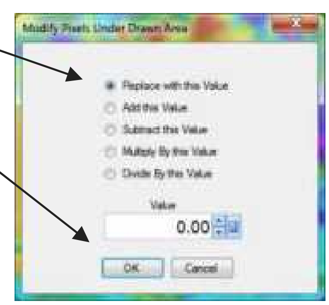
7. Select the test.grd map in "Field Data" to make it the new active layer.

Field: Farmyard Layer: Seed.grd

8. The magic wand tool should now appear on the bottom toolbar. Select it.



9. A window will appear that gives you math operations that can be performed on the area under the polygon. Choose "Replace with this Value." Enter in the new rate that will be under the Mod Area. Click OK.

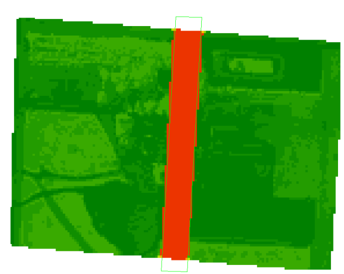


10. Make sure the test.grd is the active layer and "Save Changes." 

- Note the color table has changed due to the zero rate. The other areas will have the same rates that were entered earlier.

Export the test map

- Follow the instructions in the *Export Prescription Maps* section to bring it to the controller that will be used for testing.

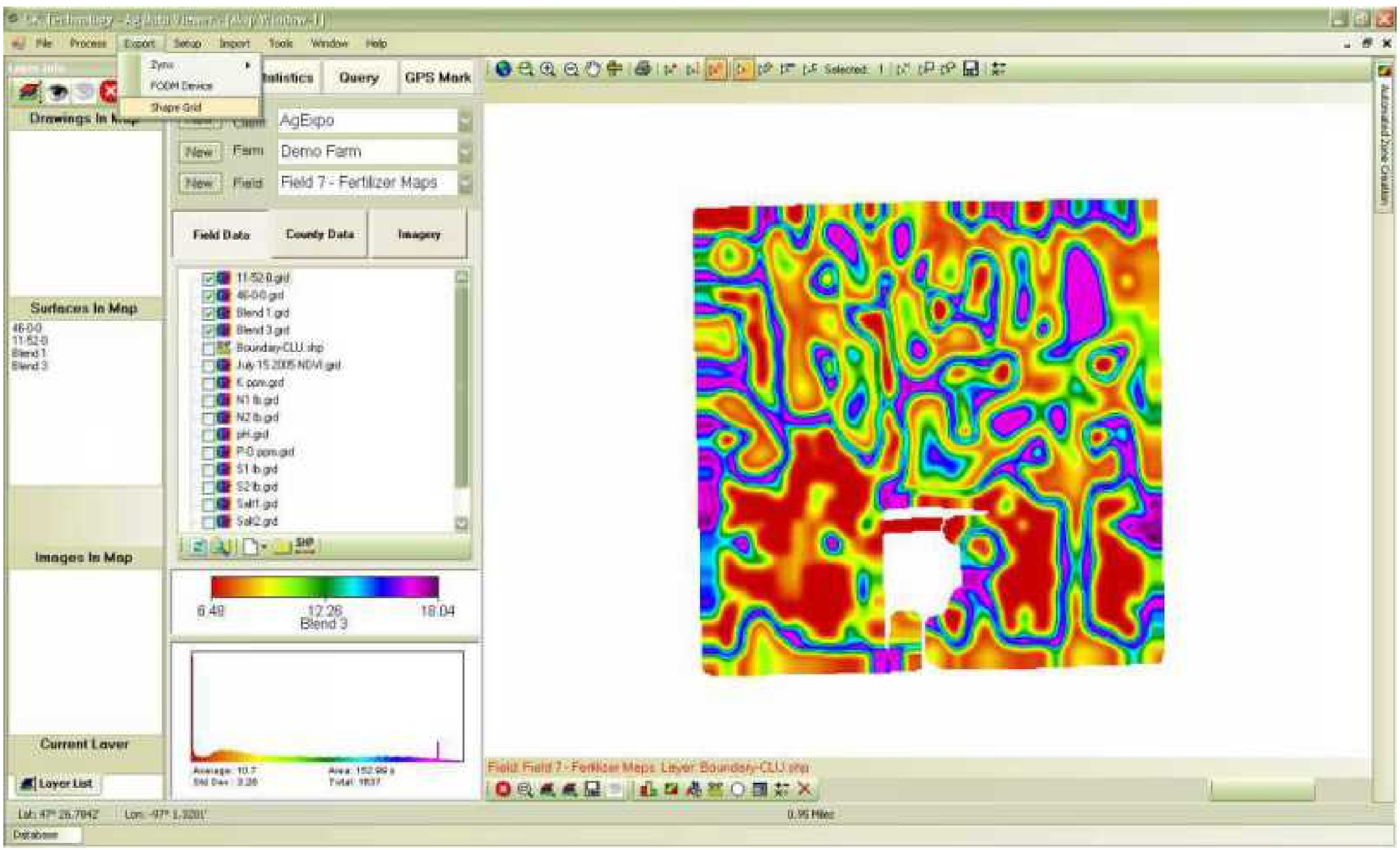


Export Prescription Maps—Shape Grids

Exporting to a Shape Grid

Exporting Shape File Notes:

Exporting files as shape grids is used for sending files directly to some controllers. It is also used to export maps to other software for map creation or for data transfer. Keep in mind, these output settings can cause controller problems even if you are going through other software. So be aware of the limitations and capabilities of your controllers and software.



Export Prescription Maps—Shape Grids

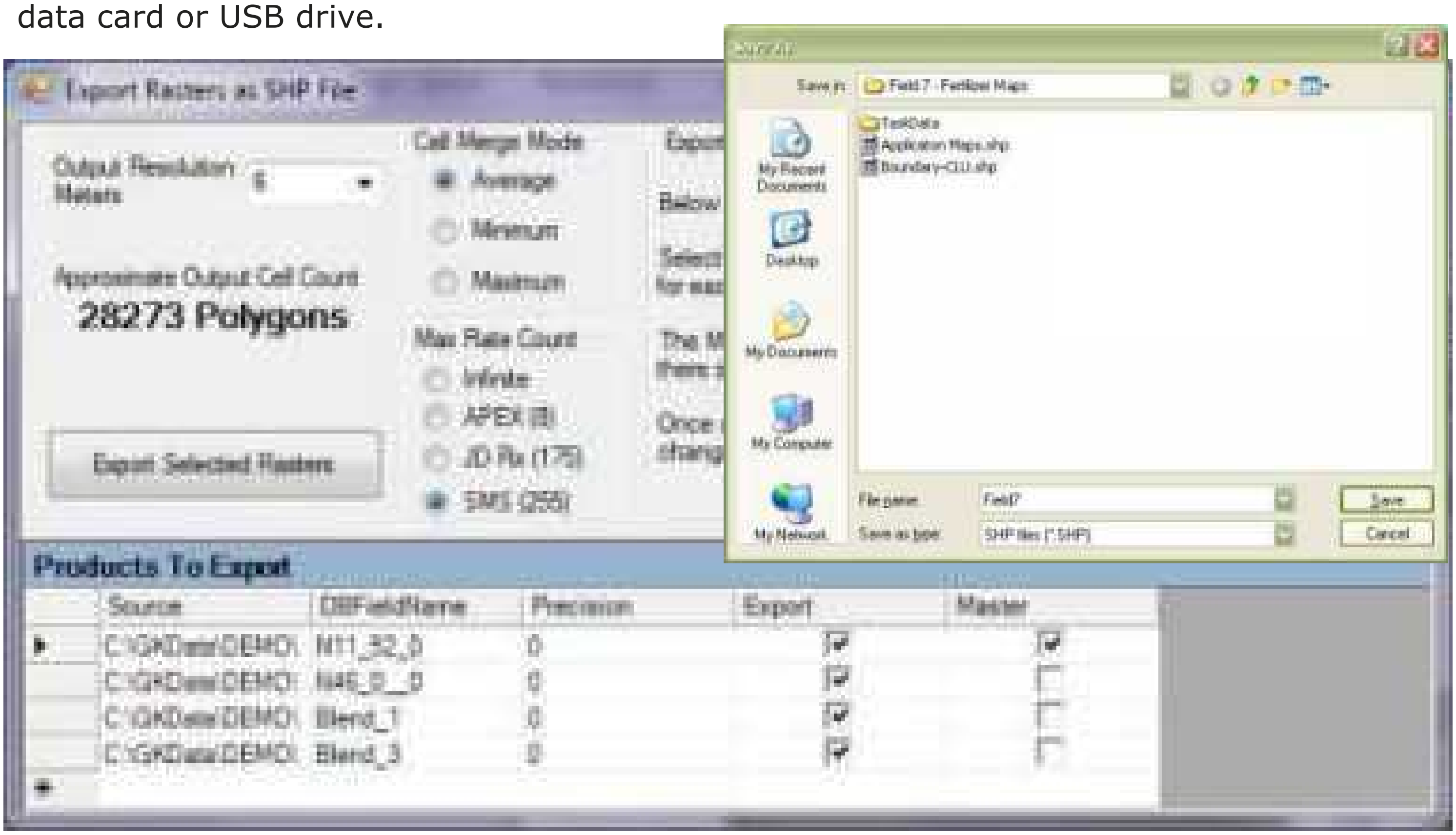
Ag Leader Insight & Integra Controllers

-Export will create a Shape file which exists as a xxx.shp / xxx.shx / xxx.dbf files)
 - Note: All 3 files must be sent out to the spreader (SHP / SHX / DBF)
-Boundary – not required to be turned on for this export
1. Select all the files to export
2. Select one layer as master
3. Note the "Precision" Column for exporting low rate products like Micro Nutrients, change the "0" to a value of 1 or 2 (1 digit after the decimal point or 2 digits after the decimal point).
4. Adjust your "Output Resolution"
 - Recommend - 6 or 8 meter
5. "Cell Merge Mode" – normally set to "Average"
6. "Max Count Rate" – set to "SMS 255
7. "Precision" column - set to "0" (is # of Decimal Points)
8. "Export Selected Rasters"
9. "File Name" use the Field Name

*Note: **Corn Seed Maps**—Your CornSeed.grd map may need to be written K-Seed/Acre.*

Meaning if you want 32,000 sds, your map should be entering a value of 32

On the data card, the SHP/SHX/DBF we suggest putting the files in a folder named "**RX**" or "**rxMaps**" on the root of the data card or USB drive.

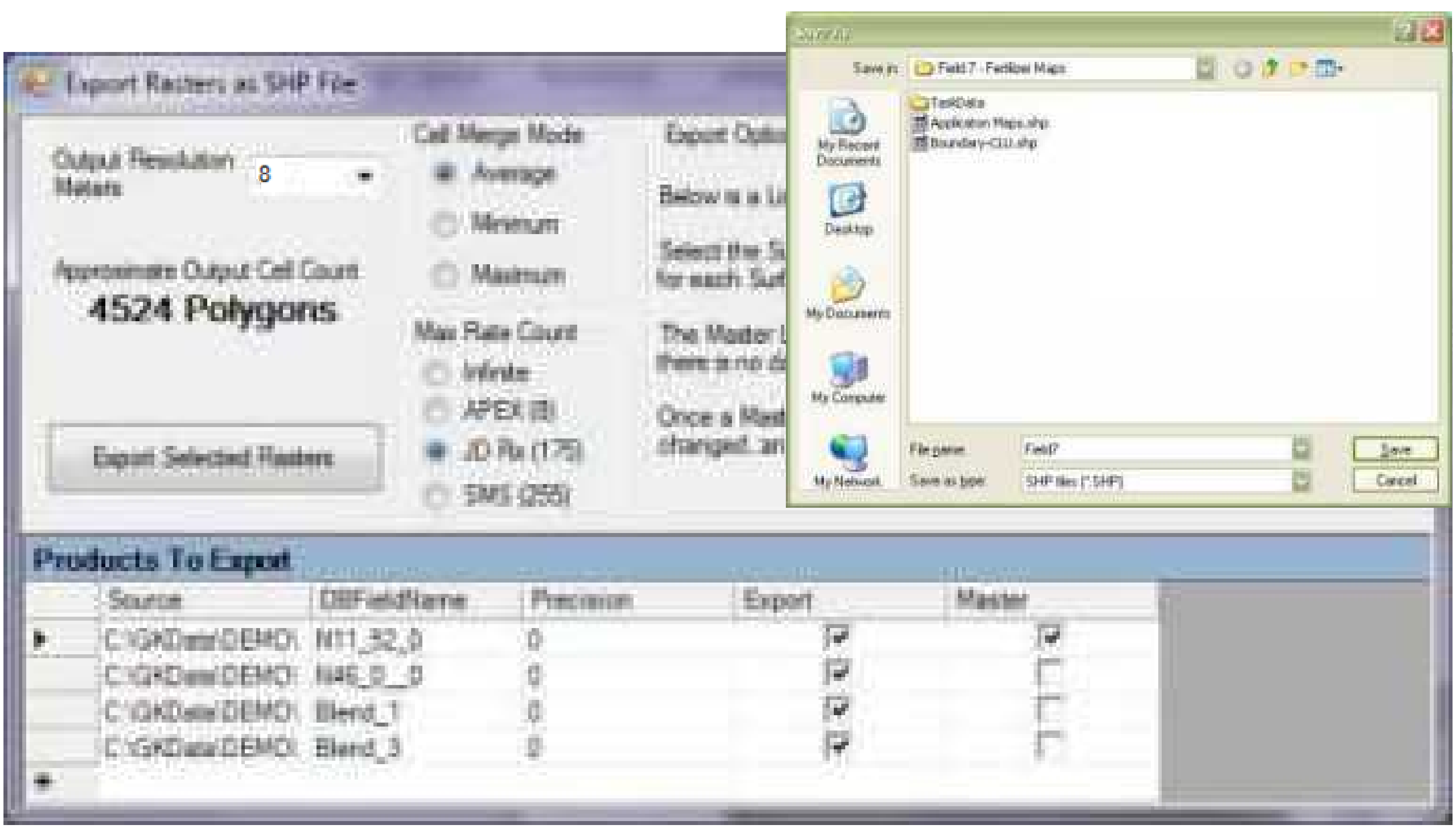


Export Prescription Maps—Shape Grids

John Deer 2600 & 2630 Controllers

-Export will create a Shape file which exists as a xxx.shp / xxx.shx / xxx.dbf files)
    - Note: All 3 files must be sent out to the spreader (SHP / SHX / DBF)
-Boundary – not required to be turned on for this export
1. Select all the files to export
2. Select one layer as master
3. Note the "Precision" Column for exporting low rate products like Micro Nutrients, change the "0" to a value of 1 or 2 (1 digit after the decimal point or 2 digits after the decimal point).
4. Adjust your "Output Resolution"
    - Recommendation from GK—6 to 8 meter (less than 30,000 polygons)
        - Recommendation from John Deere—15 meter (50 foot)
5. "Cell Merge Mode" – normally set to "Average"
6. "Max Count Rate" – set to "JD Rx (175)"
7. "Precision" column - set to "0" (this is # of Decimal Points)
8. "Export Selected Rasters"
9. "File Name" use the Field Name

On the data card, the SHP/SHX/DBF must be put in a folder named "**RX**" on the root of the data card or USB drive.



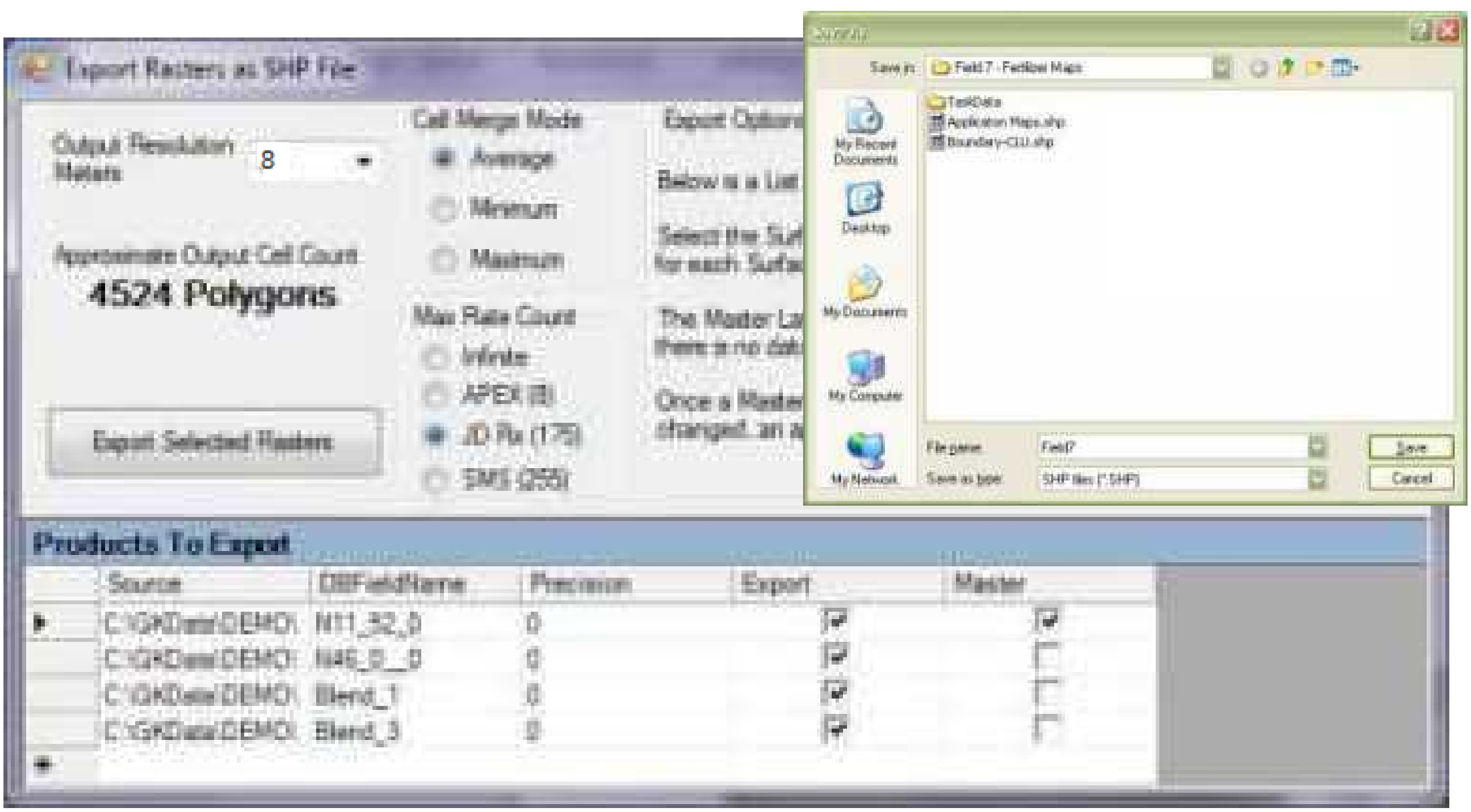
Export Prescription Maps—Shape Grids

Precision Planting 20/20

-Export will create a Shape file which exists as a xxx.shp / xxx.shx / xxx.dbf files)
   - Note: All 3 files must be sent out to the spreader (SHP / SHX / DBF)
-Boundary – not required to be turned on for this export
1. Select all the files to export
2. Select one layer as master
3. Note the “Precision” Column for exporting low rate products like Micro Nutrients, change the “0” to a value of 1 or 2 (1 digit after the decimal point or 2 digits after the decimal point).
4. Adjust your “Output Resolution”
   - Recommendation from GK— 8 meter (less than 15,000 polygons)

5. “Cell Merge Mode” – normally set to “Average”
6. “Max Count Rate” – set to “JD Rx (175)”
7. “Precision” column - set to “0” (this is # of Decimal Points)
8. “Export Selected Rasters”
9. “File Name” use the Field Name

On the data card, the SHP/SHX/DBF must be put in a folder named “**RX**” on the root of the data card or USB drive.
   Note: Suggest using the “Shape Contour” method for exporting to the 20/20



Export Prescription Maps—Shape Grids

Raven Viper & Envizio Pro Controllers

-Export will create a Shape file which exists as a xxx.shp / xxx.shx / xxx.dbf files)
    - Note: All 3 files must be sent out to the spreader (SHP / SHX / DBF)
-Boundary – not required to be turned on for this export
1. Select all the files to export
2. Select one layer as master
3. Note the "Precision" Column for exporting low rate products like Micro Nutrients, change the "0" to a value of 1 or 2 (1 digit after the decimal point or 2 digits after the decimal point).
4. Adjust your "Output Resolution"

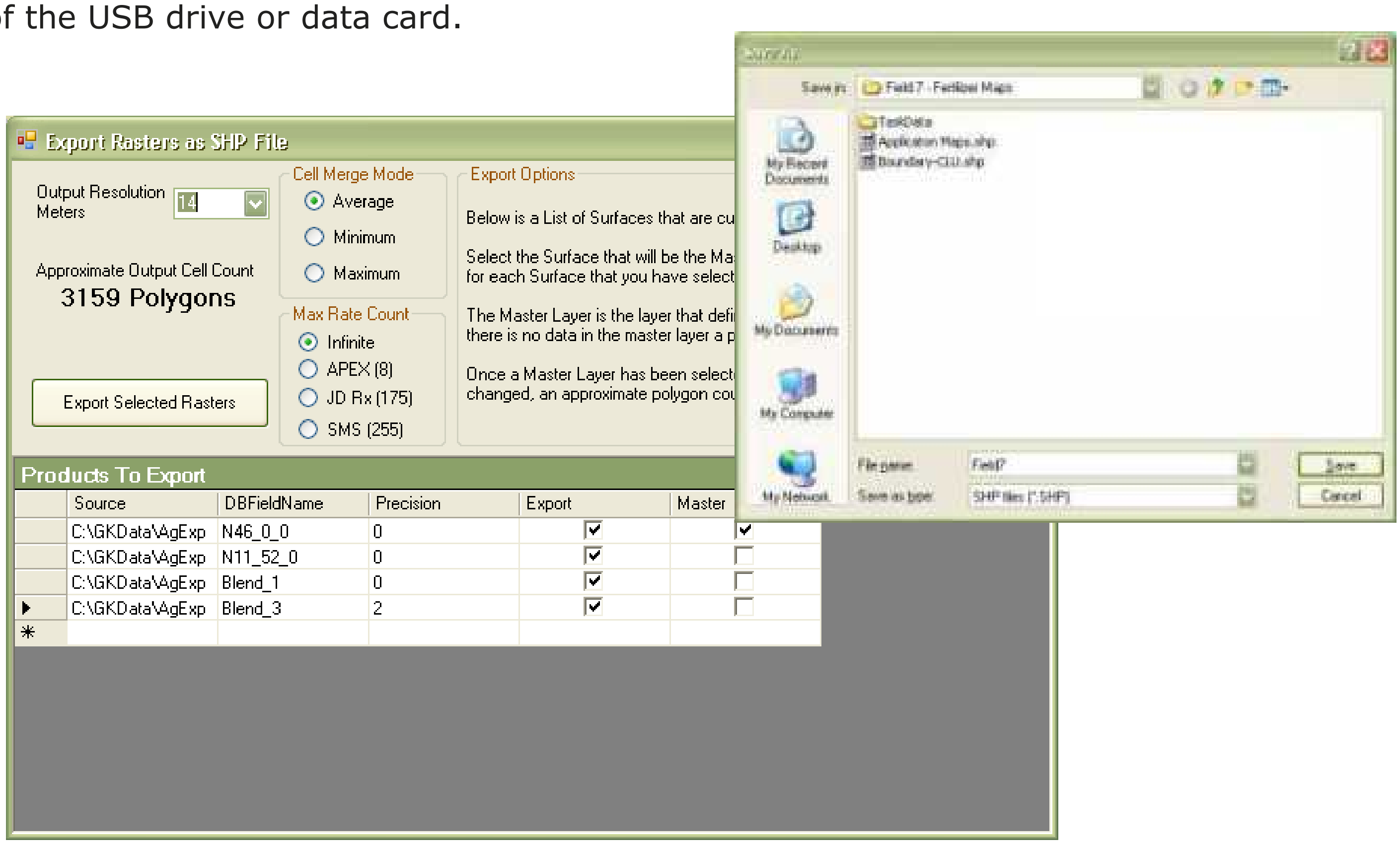
    - Viper Pro & Viper 4 are not limited on Polygons (Recommend keeping polygon count less than 30,000)

    -Viper (Original) is LIMITED to a Maximum of 4,000 Polygons

    -Envizio Pro is LIMITED to 1,500 Polygons

5. "Cell Merge Mode" – normally set to "Average"
6. "Max Count Rate" – normally set to "Infinite"
7. "Precision" column - set to "0" (this is # of Decimal Points)
8. "Export Selected Rasters"
9. "File Name" use the Field Name

On the data card, the SHP/SHX/DBF must be put in a folder named "**rxMaps**" on the root of the USB drive or data card.



Export Prescription Maps—Shape Grids

Trimble EZGuide—FMD—FMX Controllers

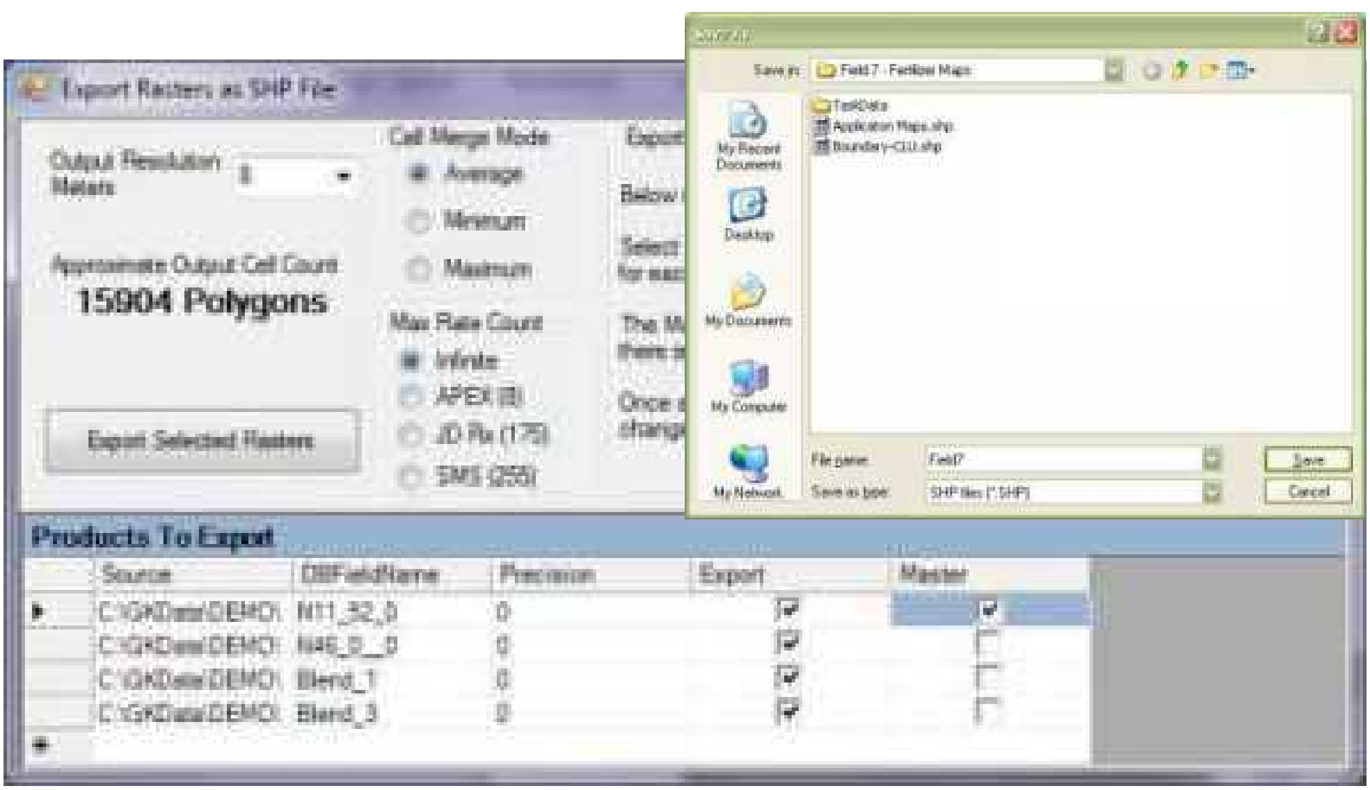
-Export will create a Shape file which exists as a xxx.shp / xxx.shx / xxx.dbf files)
- Note: All 3 files must be sent out to the spreader (SHP / SHX / DBF)
-Boundary – not required to be turned on for this export
1. Select all the files to export
2. Select one layer as master
3. Note the “Precision” Column for exporting low rate products like Micro Nutrients, change the “0” to a value of 1 or 2 (1 digit after the decimal point or 2 digits after the decimal point).
4. Adjust your “Output Resolution”

- Recommend—8 meter for FMD & FMX (max of 30,000—sum of all prod)

- EZ Guide Controllers MAX Cell Count 1,500 Polygons

5. “Cell Merge Mode” – normally set to “Average”
6. “Max Count Rate” – set to “Infinite”
7. “Precision” column - set to “0” (this is # of Decimal Points)
8. “Export Selected Rasters”
9. “File Name” use the Field Name

On the data card, the SHP/SHX/DBF must be put in a folder named “**AgGPS/ Prescriptions**” on the root of the data card or USB.



Export Prescription Maps—Shape Contour

Shape Contours to All Controllers

Below are instructions for exporting Shape files as “Contoured” Polygons. For the file structure for a given “controller” see the previous pages. All controllers will support the following instructions. This function only supports 1 product per SHP file.

-Export will create a Shape file which exists as a xxx.shp / xxx.shx / xxx.dbf files)
   - *Note: All 3 files must be sent out to the spreader (SHP / SHX / DBF)*
-Boundary – not required to be turned on for this export

1. Check on the “Product.grd” to export
   (only export 1 at a time, Ex.– 46-0-0)

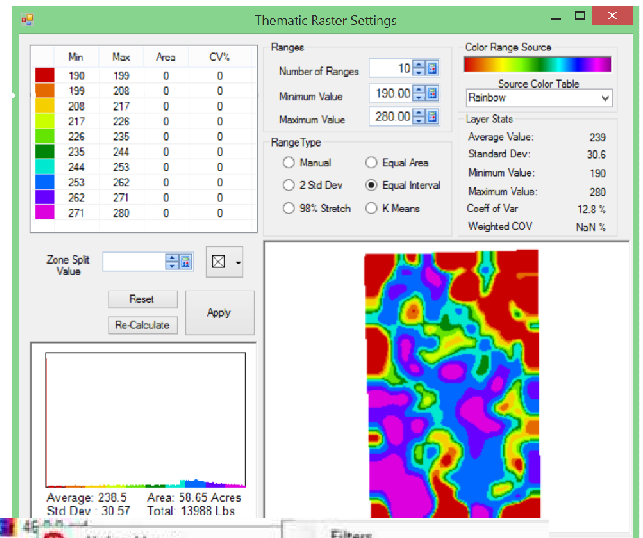
2. Click on the “Thematic Color” button 

3. Adjust the number of ranges to 8 to 12

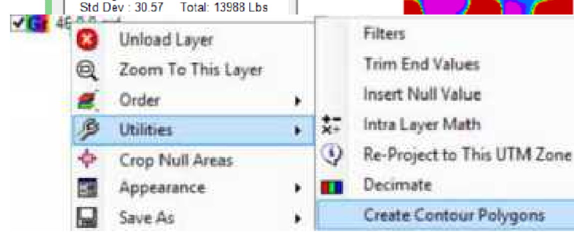
4. Range Type = Equal Interval

5. Source Color table = Preference (Rainbow)

6. Click “Apply”



7. Right Click on the File name “46-0-0.grd”
   Click—”Utilities” & “Create Contour Polygons”

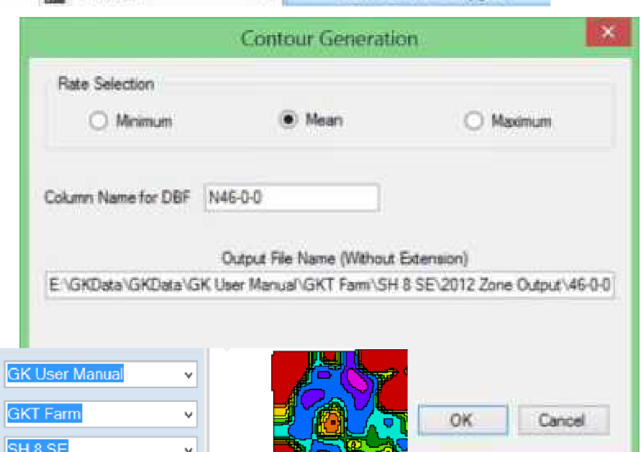


8. This will open the “Contour Generation” Window

9. Choose your “Rate Selection” (suggest “Mean”)

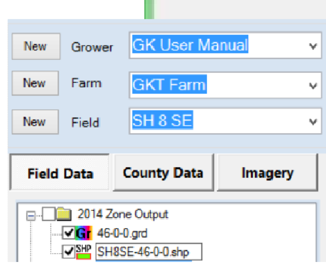
10. Leave the settings as they auto-populate.
    DO NOT—Rename

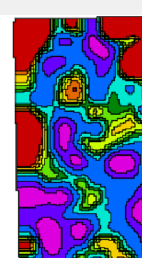
11. Click “OK”



12. Created a SHP—46-0-0.shp
    -Check “Database” if controller is limited polygons.

13. Re-Name to Field ID-46-0-0.shp
    (Ex. - SH8SE-46-0-0.shp)





SHP files are now ready to move to Controller.

Note: using this process the total LBS of product may change a significantly.

You may want to do a “Create Grid from Polygons” to create a new application.grd to print.

Export Prescription Maps - FODM Device

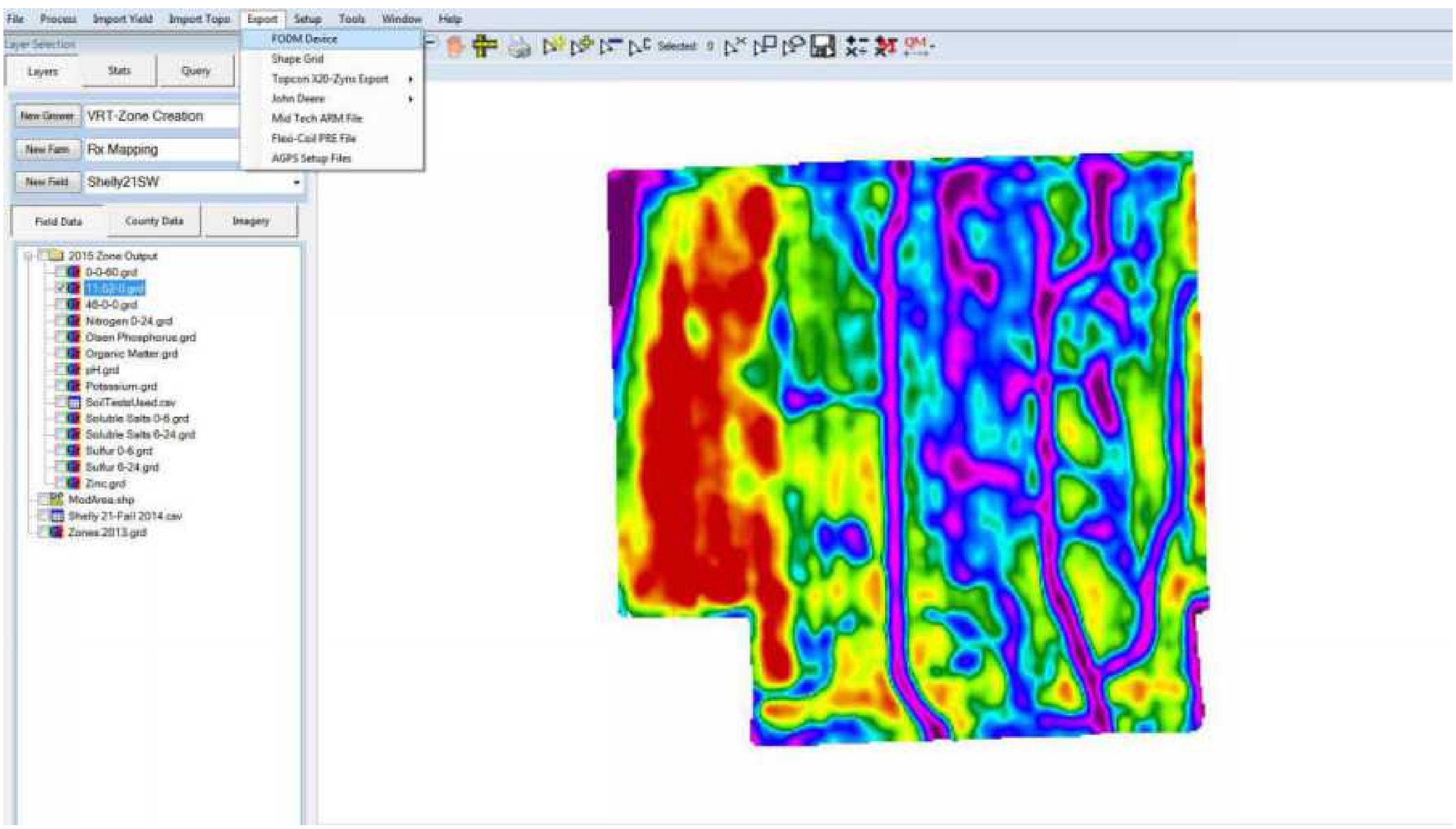
Exporting to a FODM Device

Exporting Fertilizer Prescriptions is recommended only in "**Map Window".** You will need to go to this window to print out your maps.

Make sure you have the "Field Boundary.shp" turned on and the Surface Maps you want to export. Nothing else should be turned on at this time.

NOTE: You can only export 1 FIELD at a time with multiple products per FIELD.

See the Following Pages for Instructions for YOUR Controller.



Export Prescription Maps—FODM Device

Exporting Prescription Maps

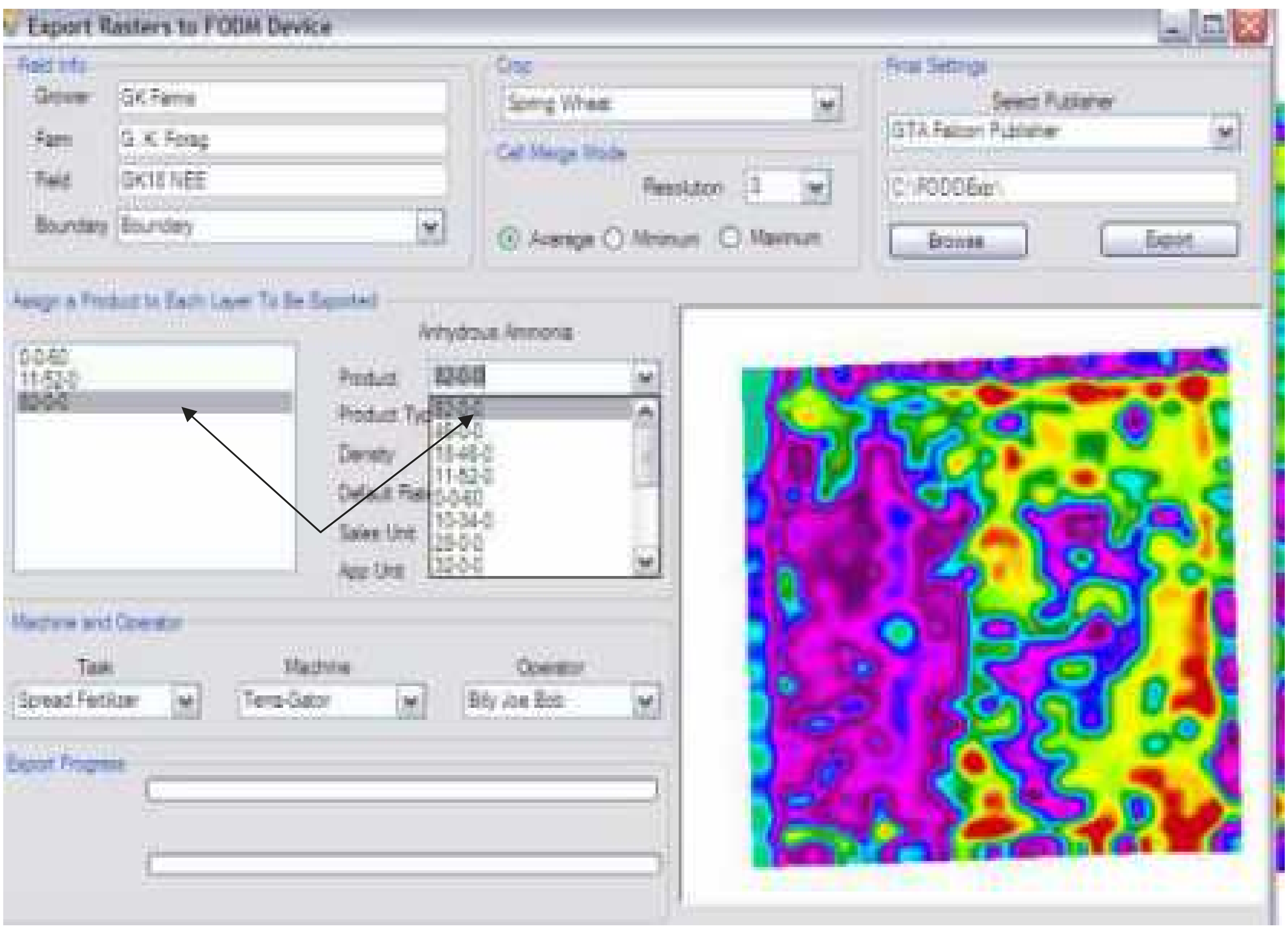
1. **"Export Rasters to FODM Device"** window and under the Field Info make sure the Grower, Farm, and Field are correct

2. Select the field boundary.

3. Next, **"Assign - Product To Each Layer To Be Exported".** This is done by "Selecting" or "Highlighting" the Prescription name and choosing the correct "Product" from the drop down list.

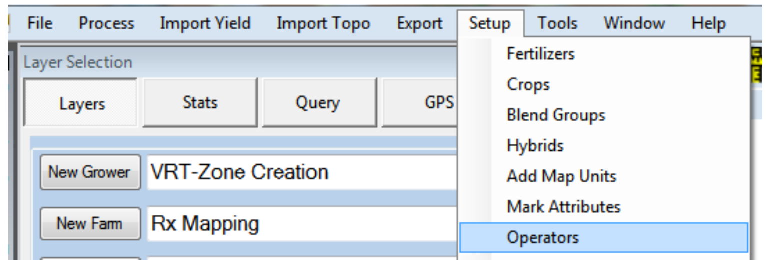
   NOTE: Default rate must be set in the "Setup" & "Fertilizers" buttons.

4. Choose your "Task"



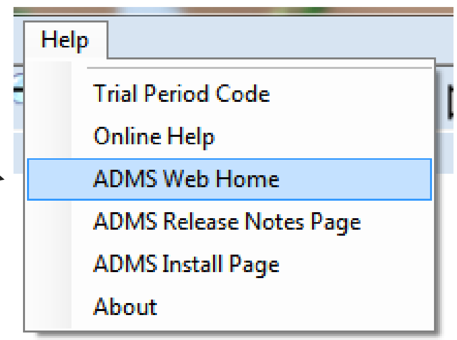
Export Prescription Maps—FODM Device

Exporting Prescription Maps



5. Choose the Task, Machine and Operator for the application. If you would like to add a Task, Machine, or Operator, this can be done by Going to "Setup" >> Tasks, or "Setup">> Operators.

6. Now you need to select the controller you will be using. Under the "Final Settings", use the "Select Publisher" pull-down menu to find the controller you are using for application.
   Note: Missing Publisher" (Controller) go to the "Help" button.



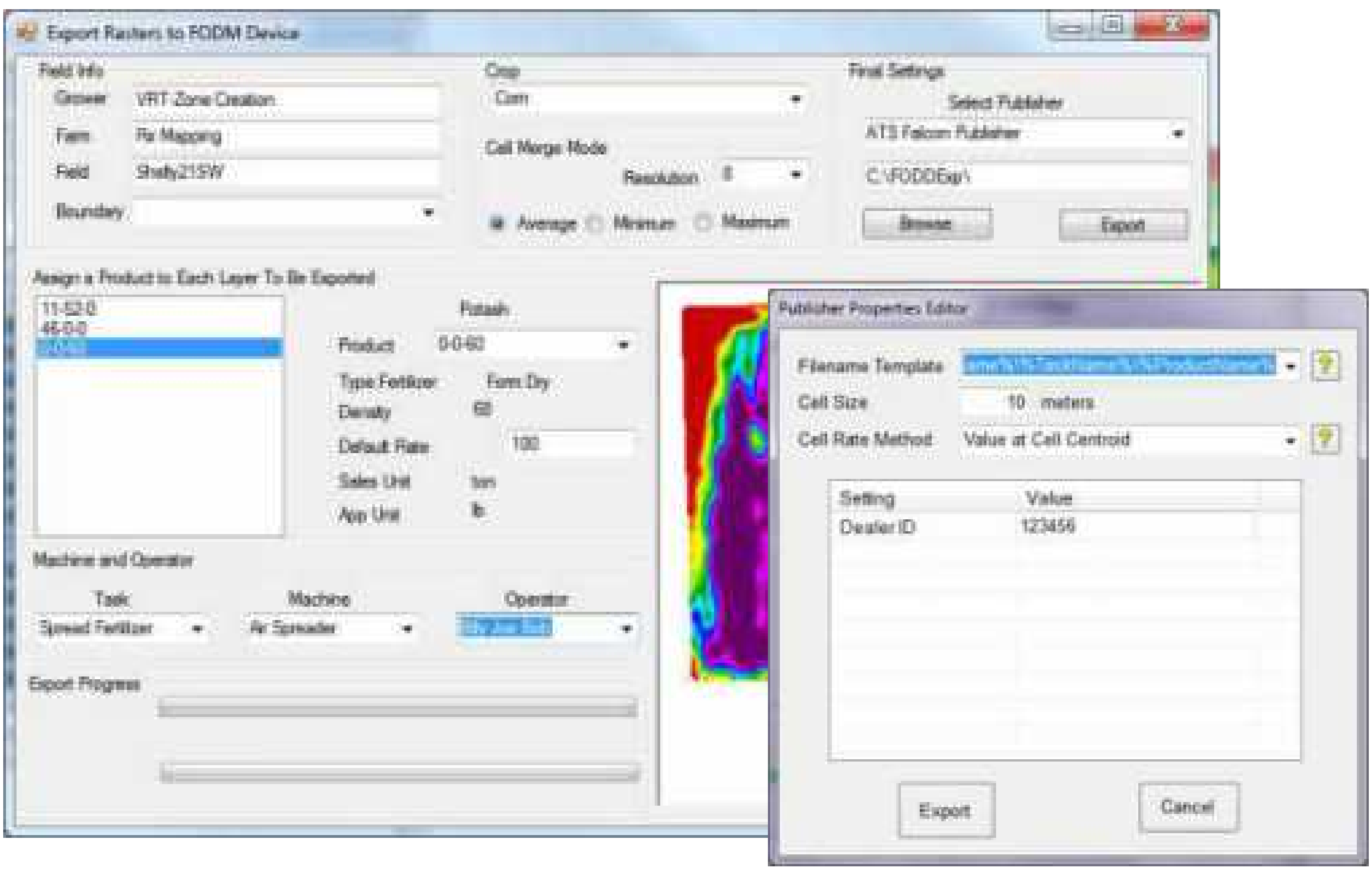
7. Use the "Browse" Button to select where you want the file exported. Usually save to the C:\FODDExp\

8. Now, you are ready to export files. Select the **"Export"** Button. This may take several minutes. When the Export is complete, copy the files to the appropriate media and take the files to the controller or applicator.

Export Prescription Maps—FODM Device

Falcon 2 Controllers

-Extension Created– xxxx.tif
-Boundary – not required to be turned on or selected from drop down
-Assign each map to its appropriate product
-Output resolution – normally set to 6 meters (Good for fields up to 1.25 miles long)
Note-this is raster based and cannot exceed 350 x 350 pixels
-Select Publisher – ATS Falcon Publisher
-Browse – Save the file back into the “Field” folder location
-Filename Template - %FarmName%\%FieldName%\%CropName%\%TaskName%\%ProductName%
-Cell Size – 6 meters (Value same as previous screen)
-Cell Rate Method - Weight Average
-Requires Dealer ID – 6 digit spreader ID
- Note: Multiple maps for the same field MUST be exported at the same time. If they are not, you will get an error while trying to load maps in the spreader (Fields are not the same size).



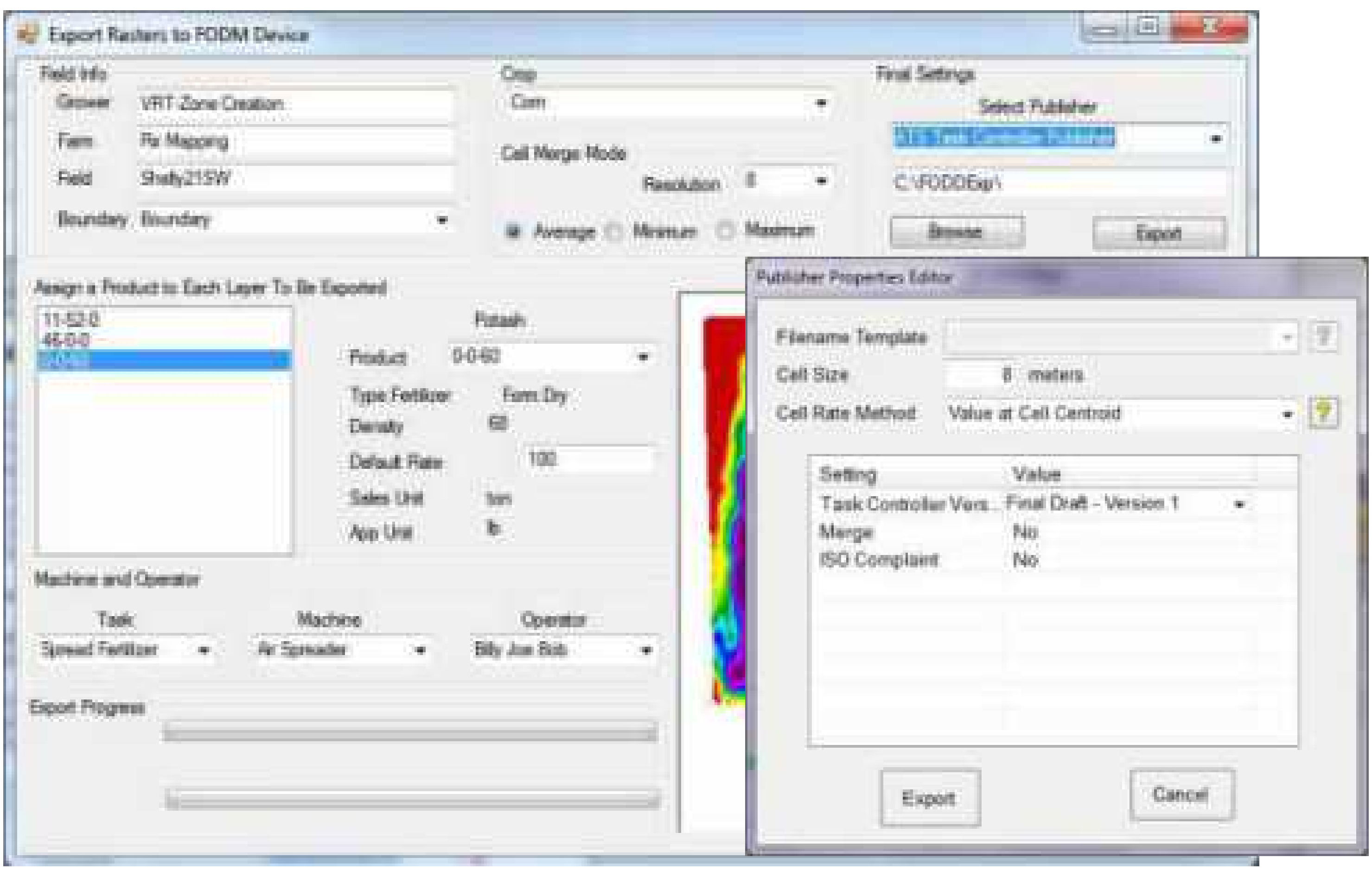
Export Prescription Maps—FODM Device

Falcon VT—AGCO GTA

-Extension Created– Multi File system, creates "TaskData" folder Unique for each field containing a GRD00000.bin / TaskData.xml / tc.xls files
-Boundary – is required to be turned on and selected from the drop down list
-Assign each map to its appropriate product
-Output resolution – normally set to 8 meters
Note-this is raster based prescription map
-Select Publisher – ATS Task Controller Publisher
-Browse – Save the file back into the "Field" folder location

-Cell Size – 8 meters (Value same as previous screen)
-Cell Merge Mode - Average
-Choose the appropriate device
- Note: Multiple maps for the same field MUST be exported at the same time.

-Cell Rate Method - Value at Cell Centroid
-Task Controller Version—Final Draft - Version 1
-Merge—No on first export (Yes if you want to send more fields to same card)
-ISO Compliant—No



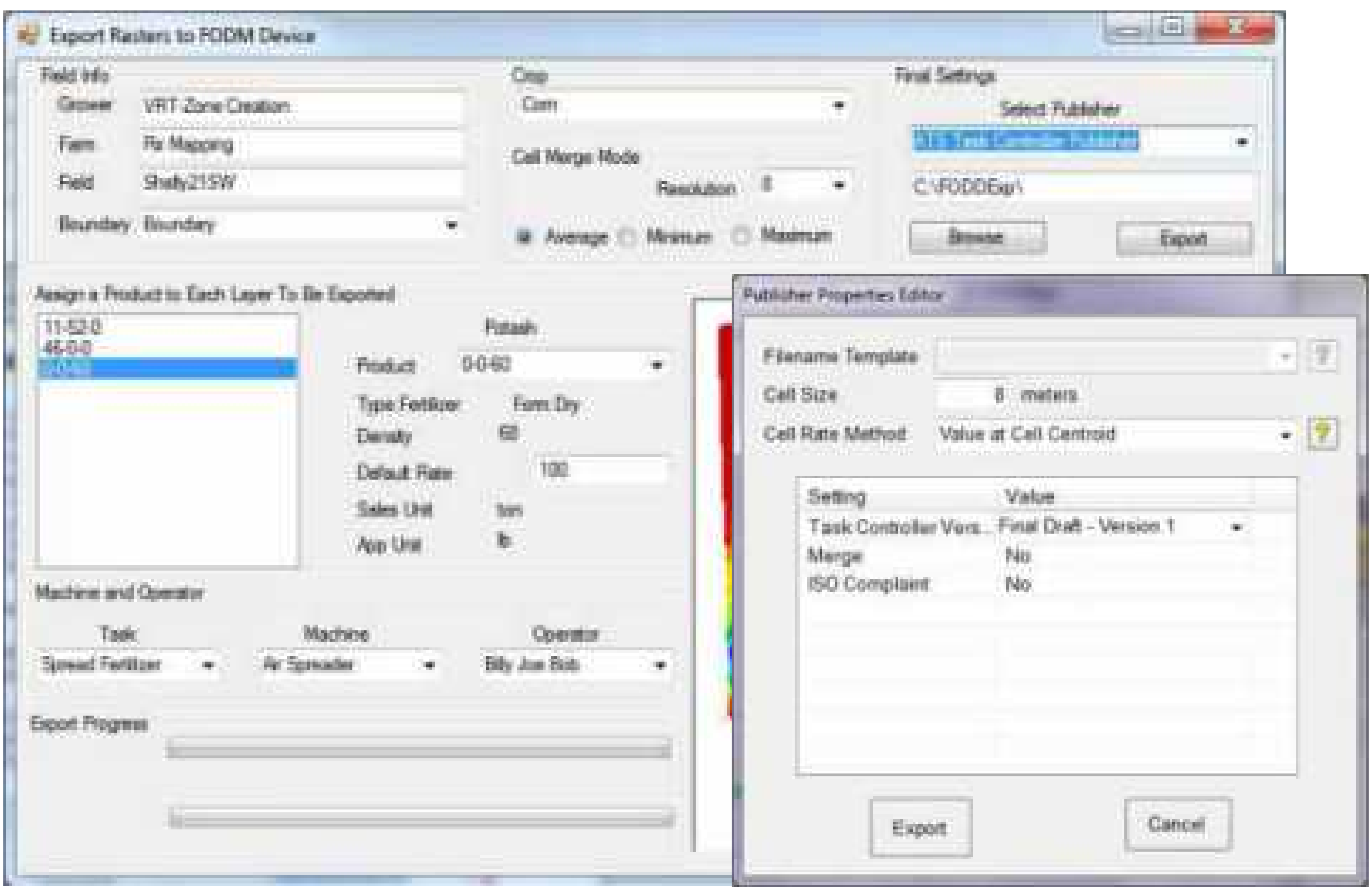
Export Prescription Maps—FODM Device

Topcon X30 / Massey Ferguson C-3000

-Extension Created– Multi File system, creates "TaskData" folder Unique for each field containing a GRD00000.bin / TaskData.xml / tc.xls files
-Boundary – is required to be turned on and selected from the drop down list
-Assign each map to its appropriate product
-Output resolution – normally set to 8 meters
    Note-this is raster based prescription map
-Select Publisher – ATS Task Controller Publisher
-Browse – Save the file back into the "Field" folder location

-Cell Size – 8 meters (Value same as previous screen)
-Cell Merge Mode - Average
-Choose the appropriate device
  - Note: Multiple maps for the same field MUST be exported at the same time.

-Cell Rate Method - Value at Cell Centroid
-Task Controller Version—Final Draft - Version 1
-Merge—No on first export (Yes if you want to send more fields to same card)
-ISO Compliant—No

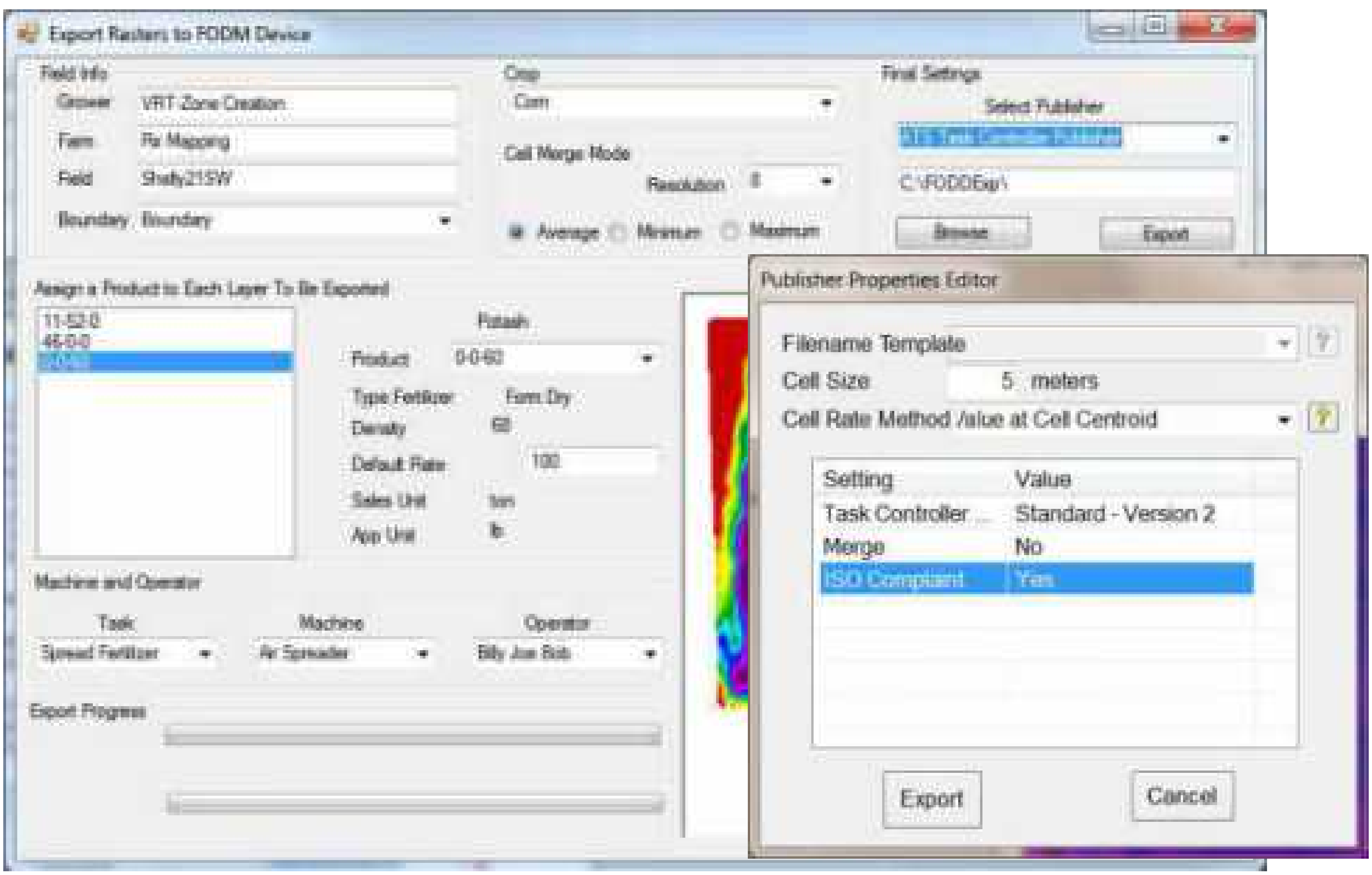


Export Prescription Maps—FODM Device

Pro 700 / IntelliView Plus II—ISO Compliant (v2.0)

-Extension Created – Multi File system, creates "TaskData" folder Unique for each field containing a GRD00000.bin / TaskData.xml / tc.xls files
-Boundary – is required to be turned on and selected from the drop down list
-Assign each map to its appropriate product
-Output resolution – normally set to 8 meters
Note-this is raster based prescription map
-Select Publisher – ATS Task Controller Publisher
-Browse – Save the file back into the "Field" folder location for single field export
Save back to "FODDExp" folder for multiple field export
-Cell Size – 8 meters (Value same as previous screen)
-Cell Merge Mode - Average
-Choose the appropriate device
Note: Multiple maps for the same field MUST be exported at the same time.

-Cell Rate Method - Value at Cell Centroid
-Task Controller Version—Final Draft - Version 2
-Merge—No on first export (Yes if you want to send more fields to same card or location)
-ISO Compliant—Yes



Export Prescription Maps—FODM Device

Ag Leader PF3000 - Insight & New Leader

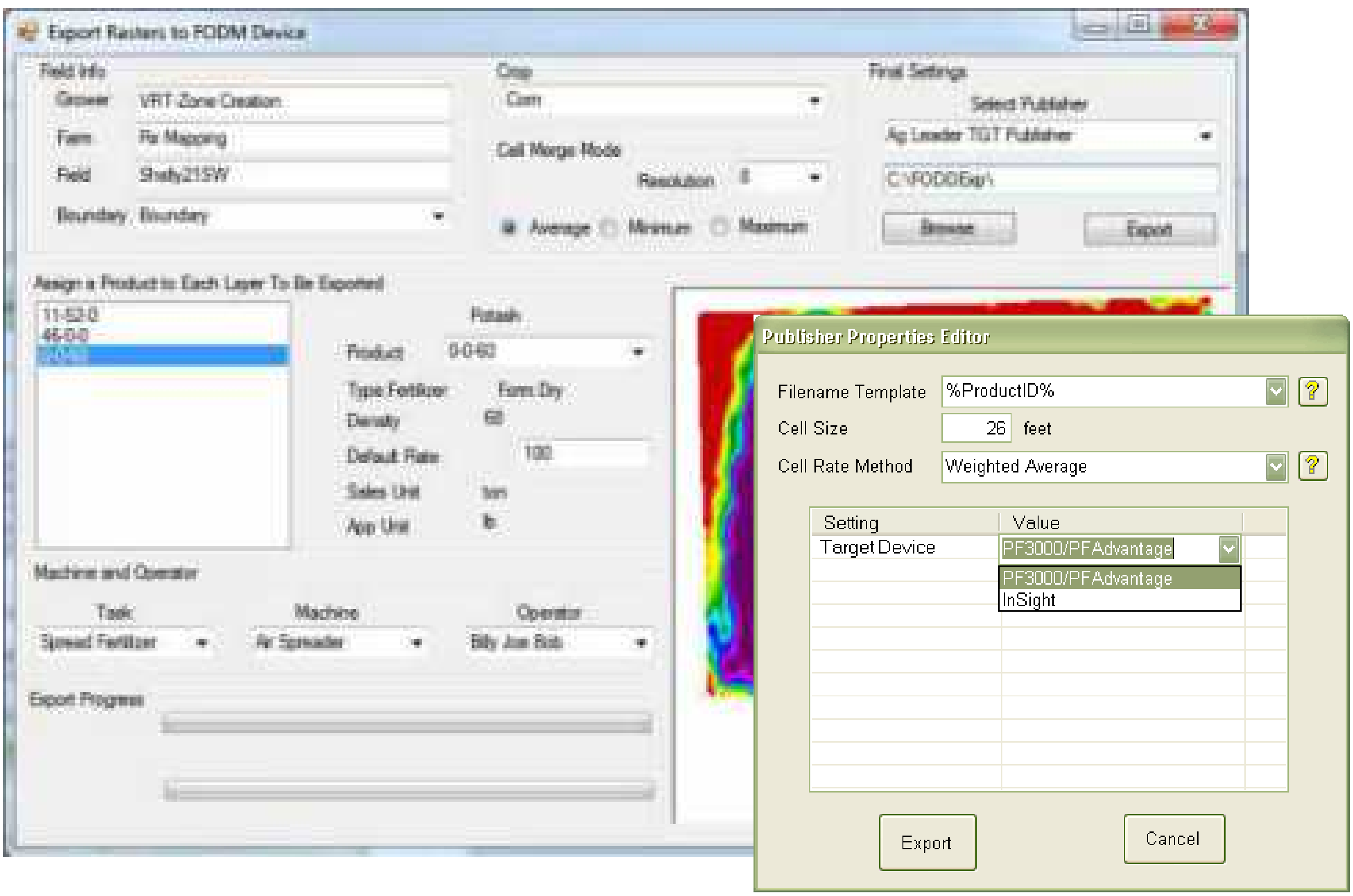
-Extension Created – xxxx.tgt
-Boundary – is required to be turned on and selected from the drop down list
-Assign each map to its appropriate product
-Output resolution – normally set to 8 meters
Note-this is raster based prescription map
-Select Publisher – Ag Leader TGT Publisher
-Browse – Save the file back into the "Field" folder location

-Filename Template - %Product Name%
-Cell Size – 26 FEET (Note the meters to feet change)
-Cell Rate Method - Weight Average
-Choose the appropriate device (New Leader use the PF3000)
- Note: Multiple maps for the same field should be exported at the same time.

- This may be a slow export depending on field size…..
-Move xxxx.tgt files to the ROOT of the Data card for application

*Note: **Corn Seed Maps**—Your CornSeed.grd map may need to be written K-Seed/Acre.*

Meaning if you want 32,000 sds your map should be 32

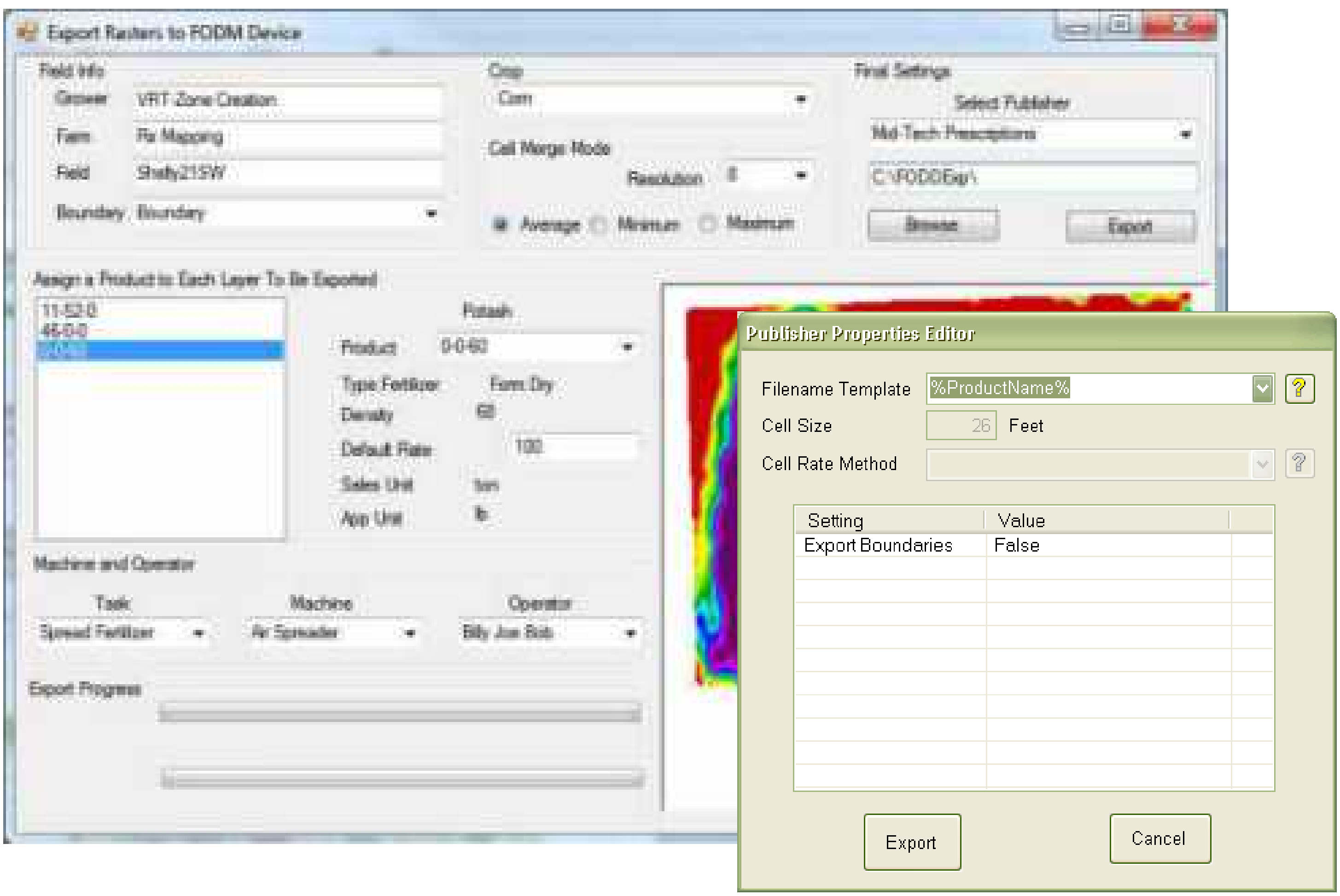


Export Prescription Maps—FODM Device

Mid Tech

-Extension – xxxx.arm
-Boundary – is required to be turned on and selected from the drop down list
-Assign each map to its appropriate product
-Output resolution – normally Set to 18 meters (up to 200 acres)
Set to 20 meters (up to 300 acres)
Set to 30 meters (up to 600 acres)
Note-this is vector based prescription map
-Select Publisher – Mid Tech Publisher
-Browse – Save the file back into the "Field" folder location

-Filename Template - %Product Name%
-Export Boundaries - False



Exporting Prescription Maps

Export a Prescription to a Topcon X20 / Zynx

1. **<u>Rates</u>** - The Zynx export uses the values in the "Thematic color" table for rate definitions.

   If you set your map to rainbow with 255 colors and you have "10 rates" in the field, you will still get 255 actual rates. If you open the object and edit with the thematic color tool and take it down to 5 zones, you will get 5 rates. It doesn't matter if you "interpolated" the map or not. (Pay attention to the color table in the lower right hand corner of the Zynx Export Window.)

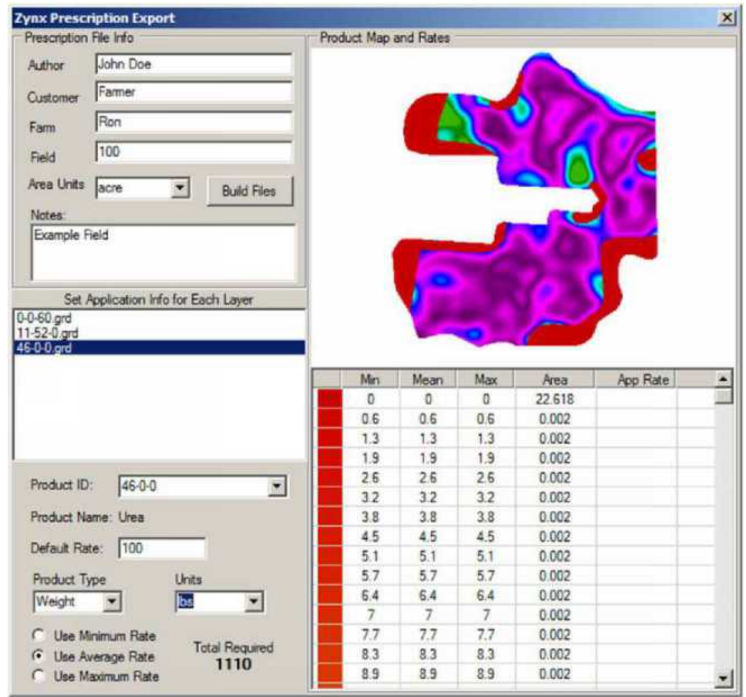
2. Start ADMS Map Window and then turn on the prescription files (i.e. 82-0-0.grd) in the order that the machine (air seeder/spreader) tanks/hoppers are arranged. The order that the layers are turned on is the tank the product goes to. (You can't change them out in the field either!!). So if the air seeder is a 2 bin and has seed in the 1st tank and 11-52-00 in the second, turn on the seed.grd file 1st, then turn on the 11-52-00.grd 2nd.

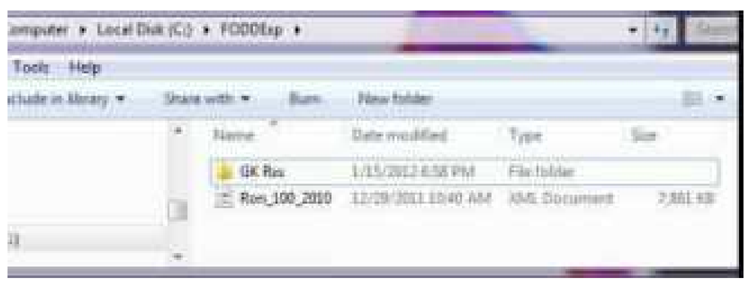
   - Unused Tanks - If the machine has a tank or a "channel" that is not being used, you need to assign a blank map to that channel / tank.

3. Now to export, on the Menu toolbar, click "Export" & "Zynx" & "Variable Rate Map".

   - A Zynx Prescription Export window should appear (see upper right).

4. Start working on the top left of the window and move your way down.





5. Fill in your name as the "Author". (This is optional).

6. Verify the "Customer", "Farm", & "Field" cells are correct (this should be filled automatically).

7. Select your "Area Units" (i.e. "acre").

8. Type in any desired notes (optional).

9. Next, set the application info for each layer. This has to be done for each product and follow this process through for each product/tank before moving on to the next product!

   a. Set "Product ID".

Exporting Prescription Maps

Export a Prescription to a Topcon X20 / Zynx

b. Type in the Default Rate (numbers only).

c. Choose the "Product Type".

d. Select the "Units".

e. Then click the desired rate (radio button).

   i. Use Minimum Rate – Drops the App Rate to the min value of that zone.

   ii. Use Average Rate – Makes the App Rate the mean of that zone (Most common).

   iii. Use Maximum Rate – Increases the App Rate to the max value of that zone.

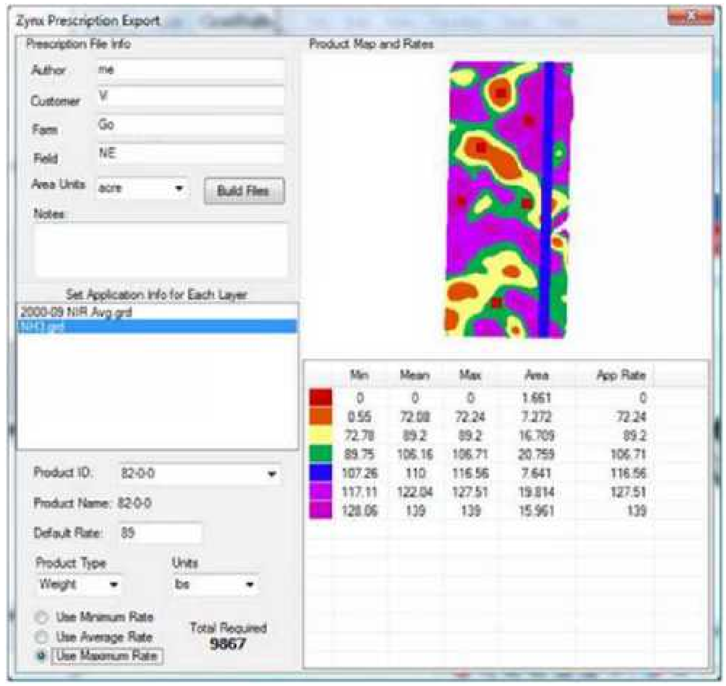
   NOTE: Pay attention to "App Rate" on the color table in the lower right of the export window! You will see the "App Rate" column does not populate until you click "Use Average Rate". (Some Rx maps will NOT get rates on a tank as a result!)

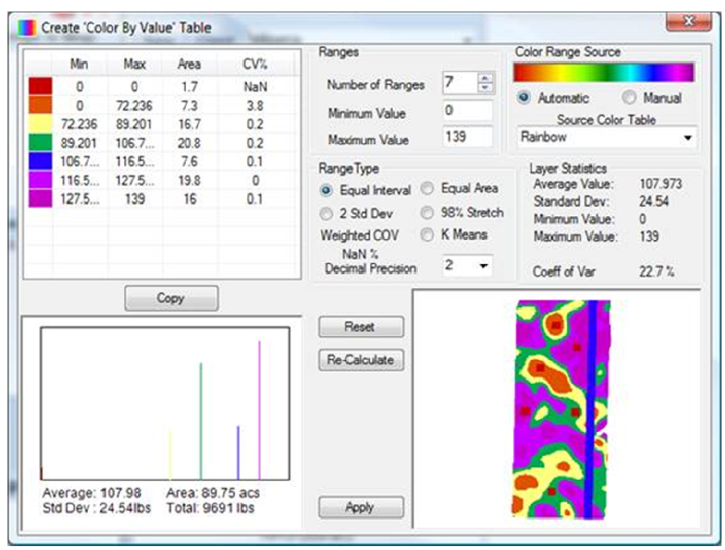
- **THEN** go back to the next layer and start this process over for each layer. Problems have occurred by not checking the ID, Rate, Type, Units and etc. in the correct sequence!

10. Click "Build Files". (It will create an ".xml" file with the Farm, Field, & Year in it (see below)).

11. That should do it. Now place that xxxx.xml file on the hard drive of the controller under the "C:\Lynx" folder.

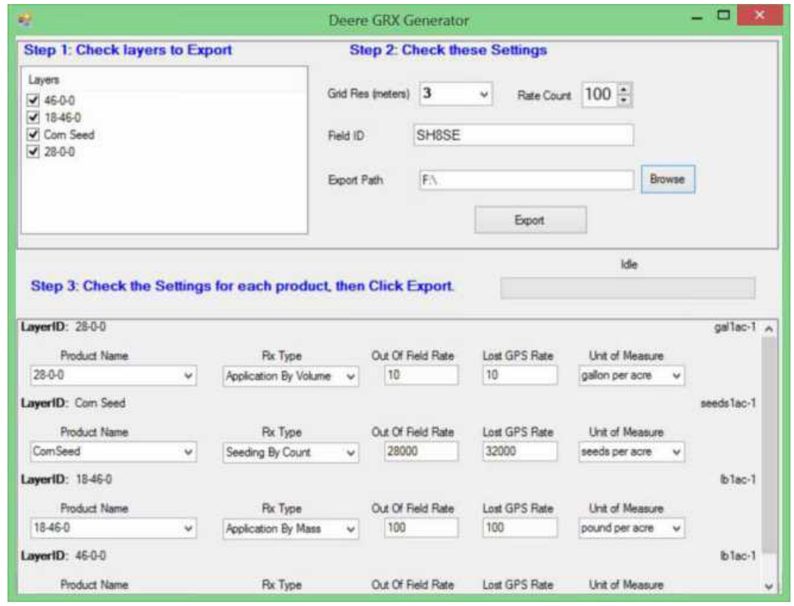
Example
Look at the "ZERO" rate on this map. The Red area was set in the thematic color to min of 0 and a max 0.00001.





Exporting Prescription Maps

Rx Map to a John Deere GS2—GS3 (2600—2630) as GRX



Layers:
Check the layers to be exported to the rate controller card.

Grid Res (meters):
We recommend leaving the "Grid Res (meters)" at "3". This should work with almost all field sizes.
(Reducing this down to 1 meter is recommended if you are doing test strips in the field.)

Rate Count:
This is the number of "Rates" that will be written into the map. For seeding, drop the "Rate Count" to the number of different seeding rates in the field. (You may want to reduce this if you are exporting a Corn seed map that only has 8 rates).

Field ID:
This will automatically populate. You may need to shorten the name due to the fact that the finished product will pull its name from this column.

Export Path:
Always write the GRX files out to the root of a jump drive or a data card. Also, you can only have 30 prescriptions in the GRX folder per data card. Do NOT save a GRX folder within an existing GRX folder!
The maps will NOT work if you do!!

***Product Name*:**
Select the type of product to be applied. (These can be modified & added in the Database tab.) If your product does not show up in the list, go to "Database" and "Products".

Out Of Field Rate:
This is the rate used when traveling outside of the field boundary.

Lost GPS Rate:
This is the rate used when the GPS signal is lost.

Unit of Measure:
This is the unit of measure for the desired application. Match this to the prescription map.

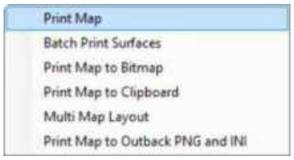
Rx Type:
- **Liquid applicators** get "Application By Volume"
- **Dry Fert** gets "Application By Mass"
- **Row crop planters** get "Seeding By Count"
- **Air seeders with seed** get "Seeding By Mass"

Final Step: Click "Export"

NOTE: Seeding / Planting & Liquid products - must re-select the "Rx Type" & "Units of Measure"

My Notes

Printing



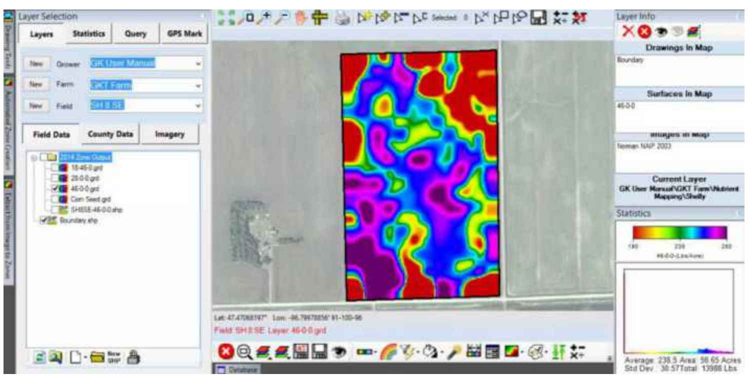
Print—Tools and Tips

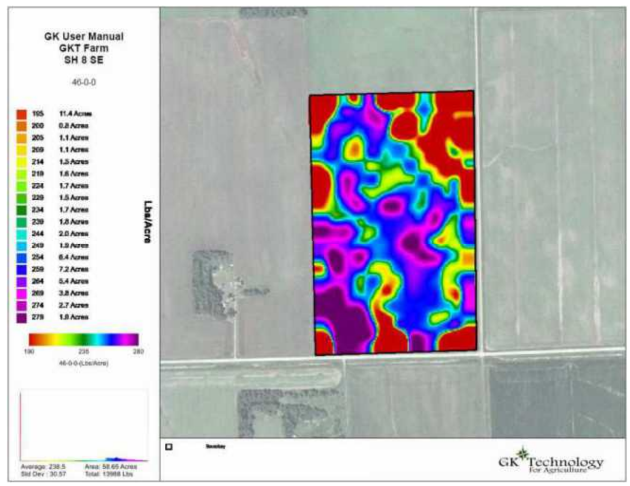
Printed maps are used to convey or transfer data to customers and co-workers. Whatever you see in the window is what will show on the "Printed Map".

If you want a logo on the bottom of the map, you must add it by going to "Tools" and "Set Current Logo" (logo must be an image format of jpg / bmp / png / gif).

When printing any maps, take note of the shape of the "Map Viewing" area. If you have a "wide screen" monitor, your viewing area is a wide rectangle. This will make for a Printed map that will get sized down. Simply pinning open the "Drawing Tools" will resize the map window. Basically make the Map window viewing area something near a "Square" viewing area.

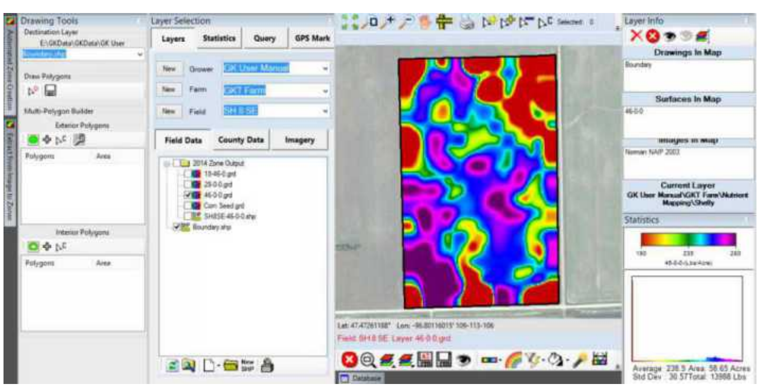
Note the shape of the Map window on the "Left". Now look at the Print out on the "Right"

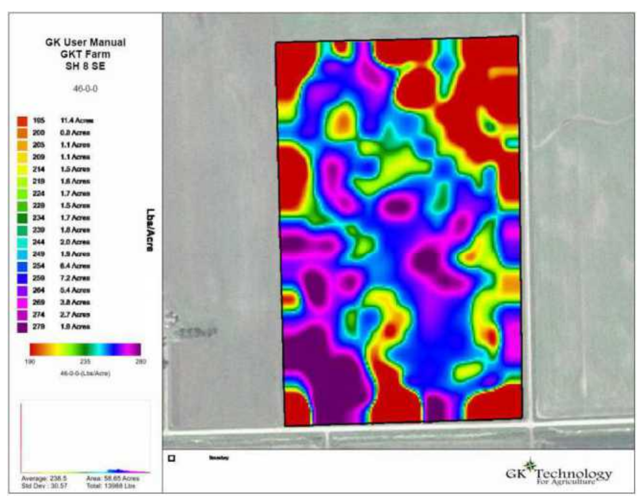




Resized Map window

Printed map

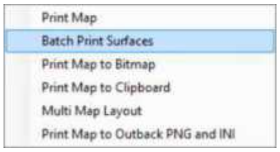




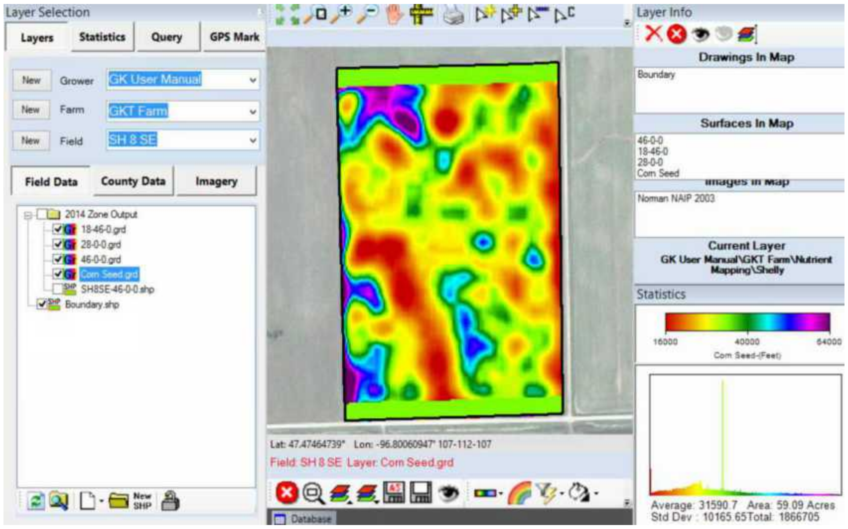
Color Bar—Shows Min & Max values of the surface
The Acres on the Color Chips MAY NOT add to field total acres (more Colors than Chips)

Statistics—Shows the Average—Acres—Standard Deviation—Total Product/Units

Printing

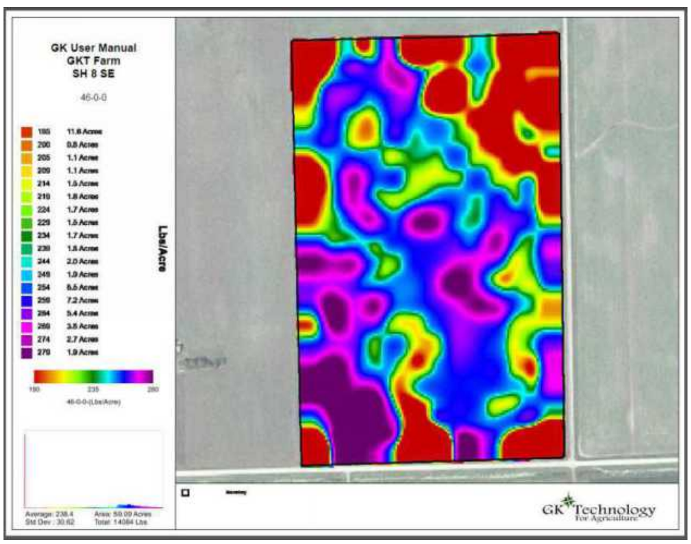


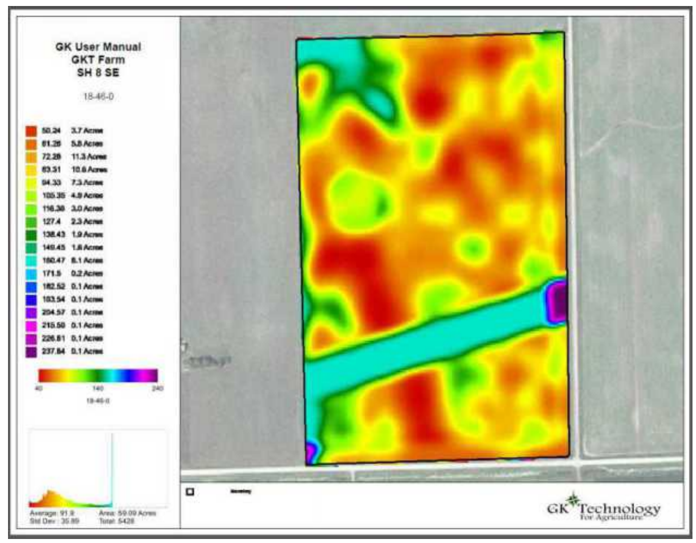
Print—Batch Print Surfaces

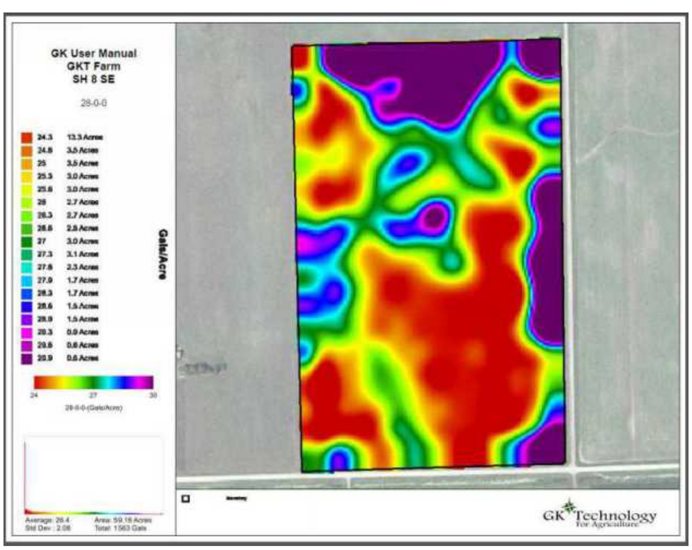


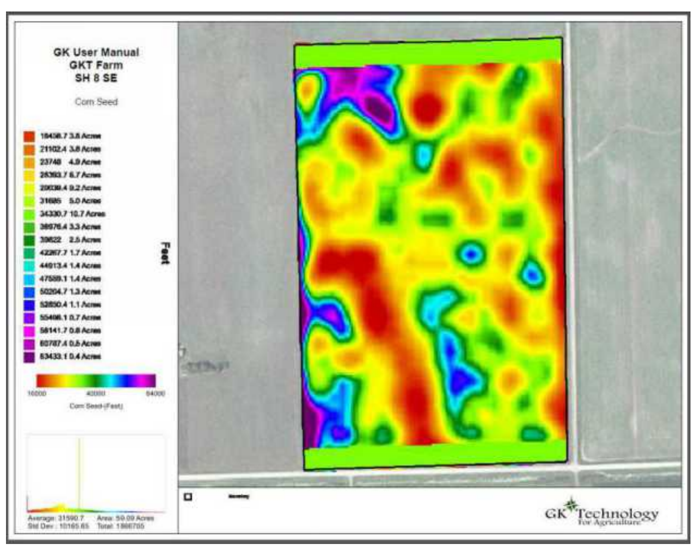
If you have Multiple Surface Maps to print out, turn them on in the order you want them to be printed.

Go to Print & Batch Print Surfaces

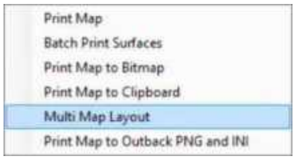




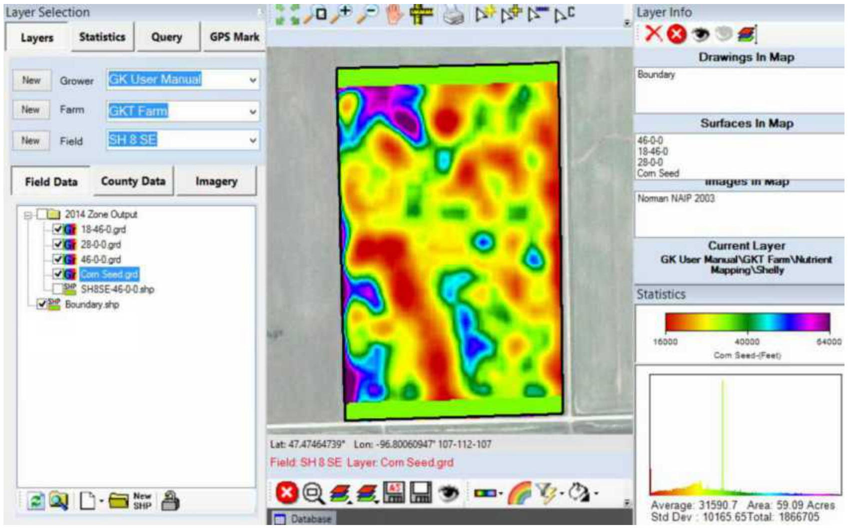




Printing



Print—Multi Map Layout

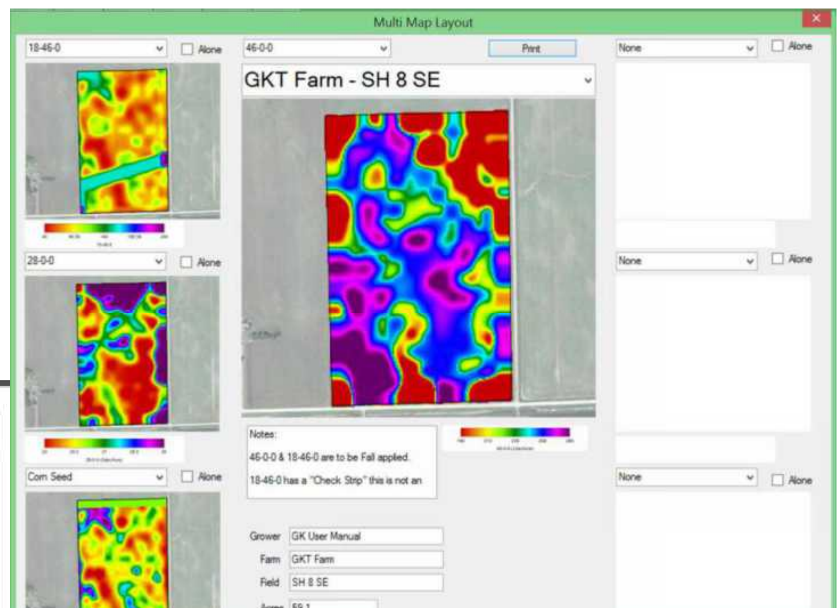


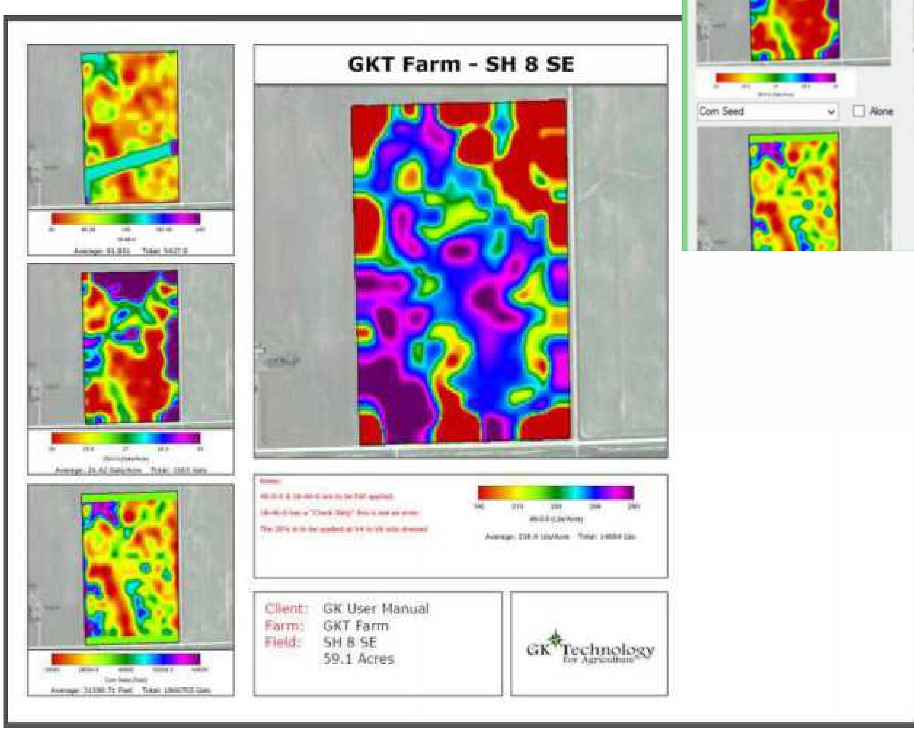
This function will print 7 maps on 1 page.

If you have Multiple Surface Maps to print out, turn them on in the order you want them to be printed.

First map turned on goes to the middle. Then top to bottom & top to bottom

Go to Print & Multi Map Layout



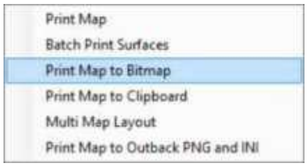


Type the "Custom Header"

Re-order or re-locate maps by click the drop downs above the images.

Type any "NOTES" you want in the middle box. (limited to roughly 15 lines of text)

Printing



Print—Print Map to Bitmap

Print Map to Bitmap takes a "Geo-Referenced" screen shot of the map window. These maps can be taken to other software packages and allow you to have 1 map to show many pieces of data. This function is designed for "FIELD DATA", NOT FOR Township or County viewing. This does not work well on data AREAS larger than 2 or 3 miles square.

1. Turn on all the data you want to see in final map

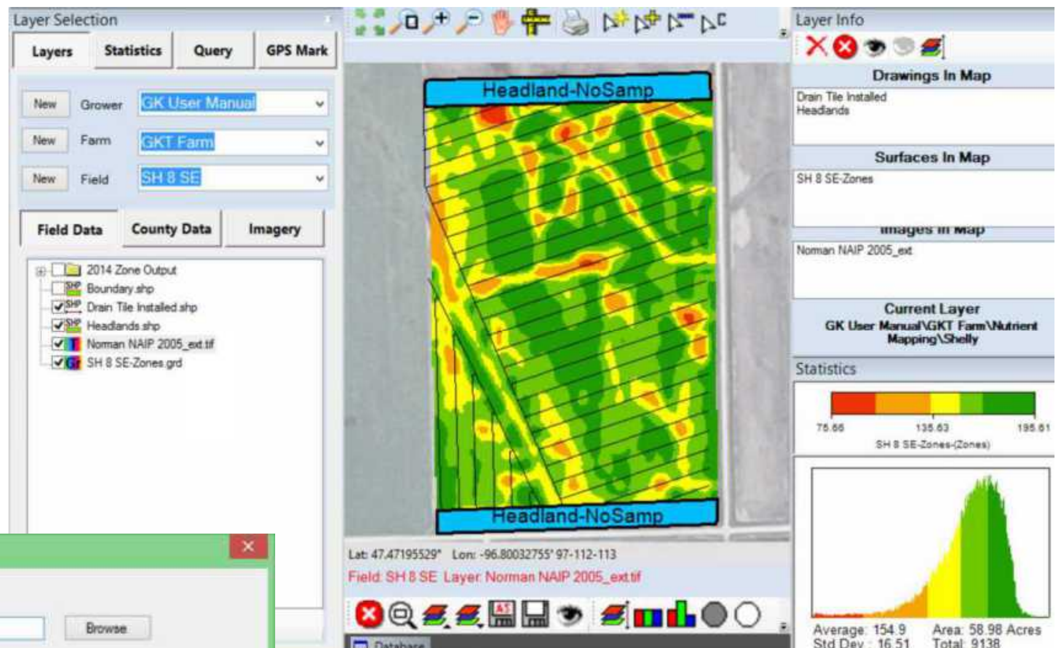
2. Layer the data in the correct order.

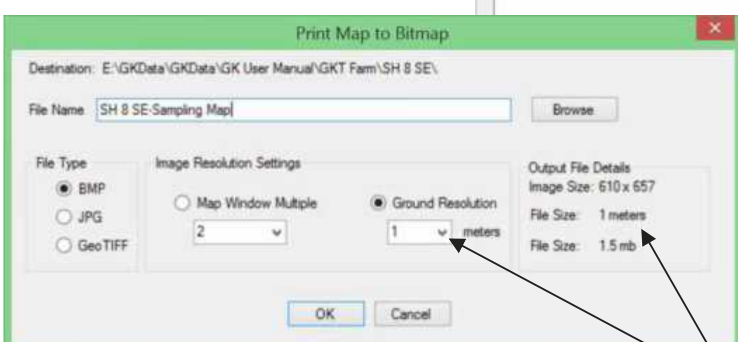
3. Zoom in tightly on the data you want to Print.

4. If you are using labels, make sure they are large enough to read.

5. Go to "File" "Print" "Print Map to Bitmap"

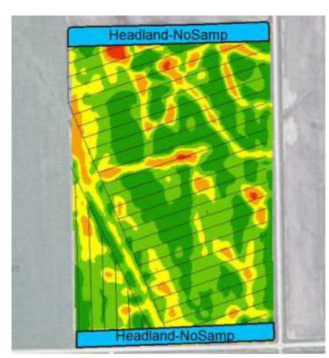
6. Assign a "File Name".
Typically Field-Event
Ex. -SH 8 SE-Sampling Map





7. Choose "File Type"
Depends on what software you are going to?
Most support BMP.

8. Choose "Image Resolution Settings"
Suggest trying to keep your Resolutions in that 1 to 2 Meter range no greater than 5.0mb in size. Some software & Controllers are limited on what file size you can send them.
Adjust values by moving between "Map Window Multiple"&"Ground Resolution"

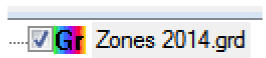


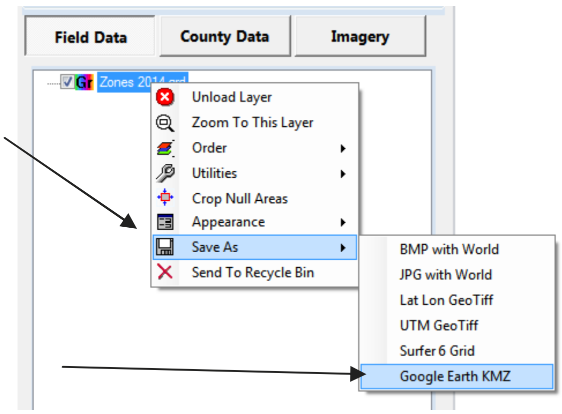
9. Click "OK"

10. For these files to work you will have to move both the image file and the world file.
(bmp & bpw or jpg & jgw or tif & tfw)

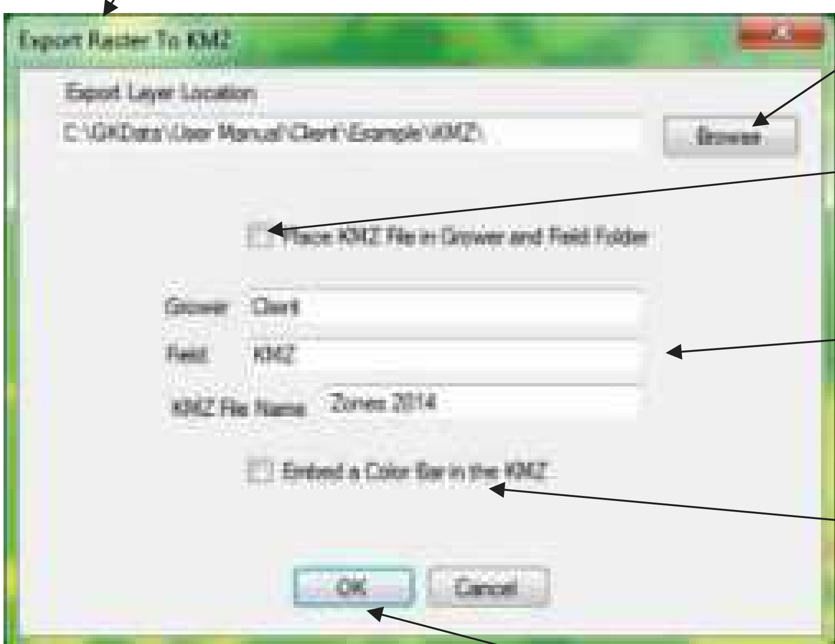
Exporting Files As KMZ For Google Earth ™

Google Earth™ allows images to be opened within the desktop software or on a mobile version such as Android or iOS. This file is called a KMZ file (Zipped Keyhole Markup Language). The single file contains both the geo-referencing file and the image which will be displayed as an image overlay in Google Earth™. Once exported the KMZ file can simply be opened and Google Earth™ will zoom to its location. Only images and surfaces are supported in this export.





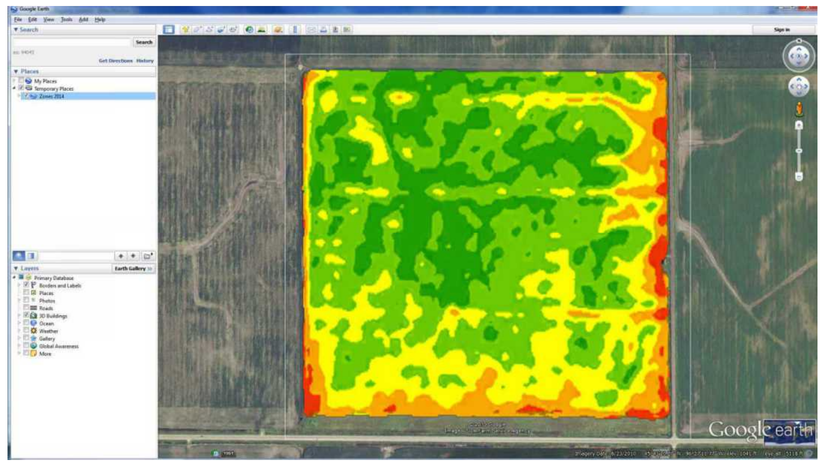
1. Turn on the layer that will be exported.
2. Right click on the file select: Save As => Google Earth™ KMZ
3. The “Export Raster To KMZ” options will open.

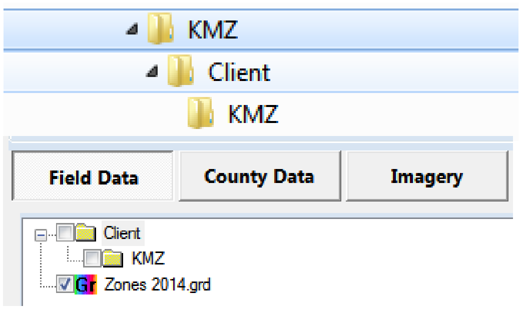


4. Browse to the desired export location
5. *Optional:* Place KMZ in Grower and Field folder. This will export to the selected location, but will place the file in a Grower & Field folder structure.
6. *Optional:* Edit the Grower, Field, and KMZ File Name if desired.
7. *Optional:* Embed a Color Bar in the KMZ. This will show the statistical color bar on Google Earth™ giving the ranges of the map. (This can only be done with surfaces)
8. When all of the desired options are selected click “OK.” The file will be exported to the selected directory with the options that were selected.
9. A program will have to be installed on the device you are using (Windows, Android, iOS) to read the KMZ file (Google Earth).

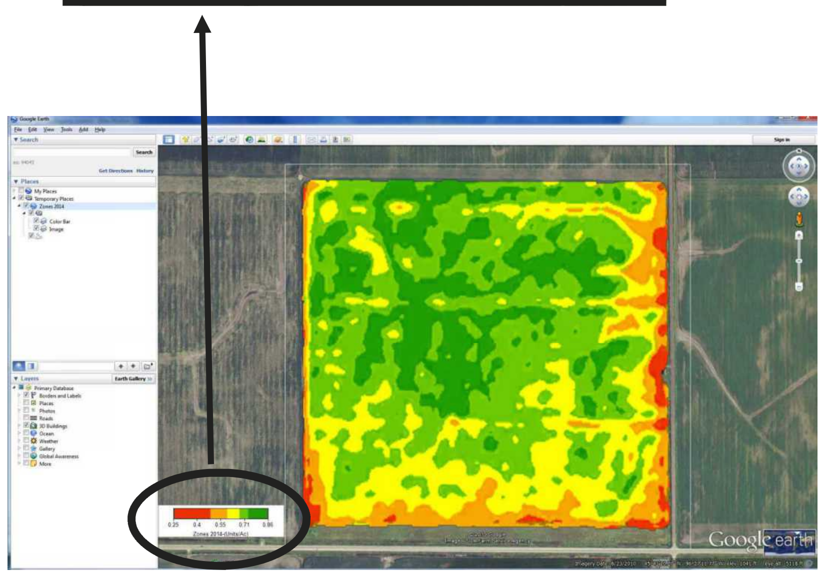
Exporting Files As KMZ For Google Earth ™ - Examples

This is an example of the file structure that will be created when the option to "Place KMZ in Grower and Field Folder" is selected. The KMZ file WILL NOT be recognized in ADMS.





This example will show the statistical color bar if "Embed a Color Bar in the KMZ" is checked on.

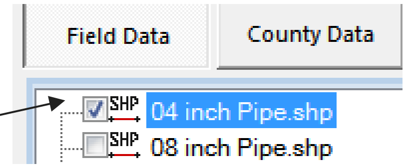


Exporting KML Files For Google Earth ™

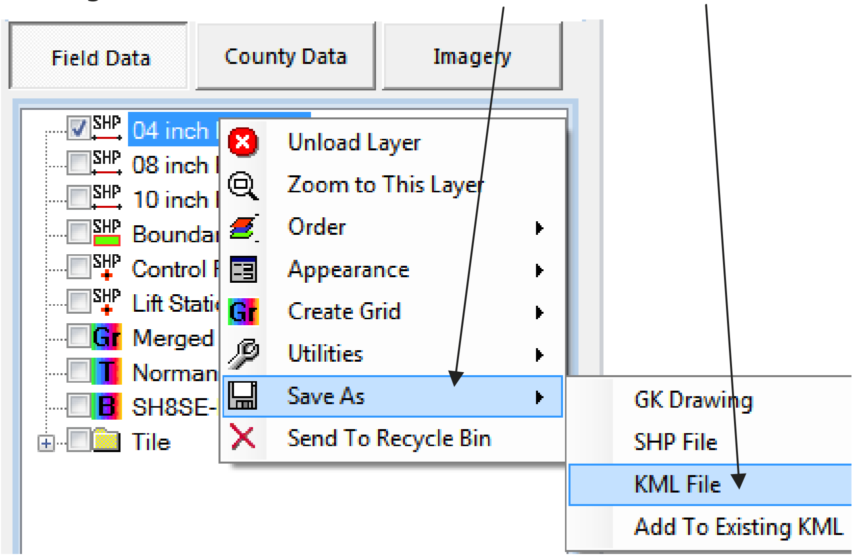
Google Earth along with some other software packages will allow vector files to be opened within different desktop and mobile applications. The file type that is used has the extension *.KML which stands for keyhole markup language. Vector files such as points, lines, and polygons can be saved to one or multiple KML files for viewing in these applications.

Saving Vector Files As KML Files

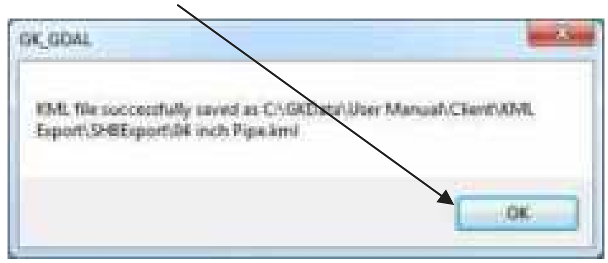
This example will use a tile plan as an example.



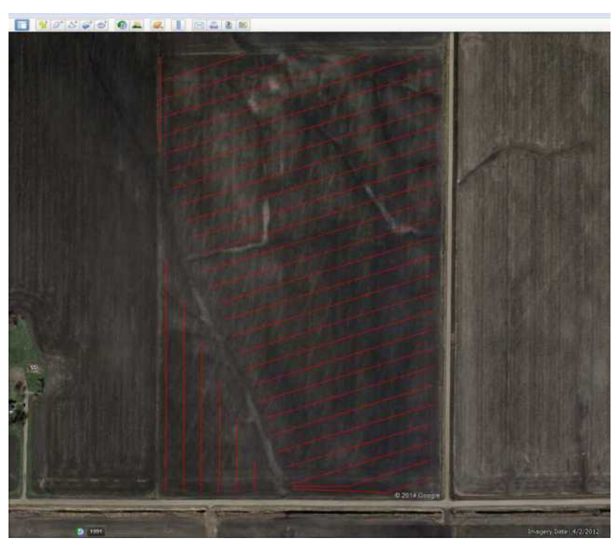
1. Turn on the SHP file that you wish to save as a KML.
2. Right click on the file select Save As ► KML File.



3. After selecting "KML File" a window will appear saying that it has been successfully saved and the path where it was saved to. These files will get saved to the same location as the SHP file they were saved from.
4. Click "OK."



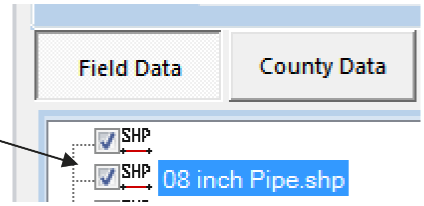
The KML file can now be opened in Google Earth or other applications.



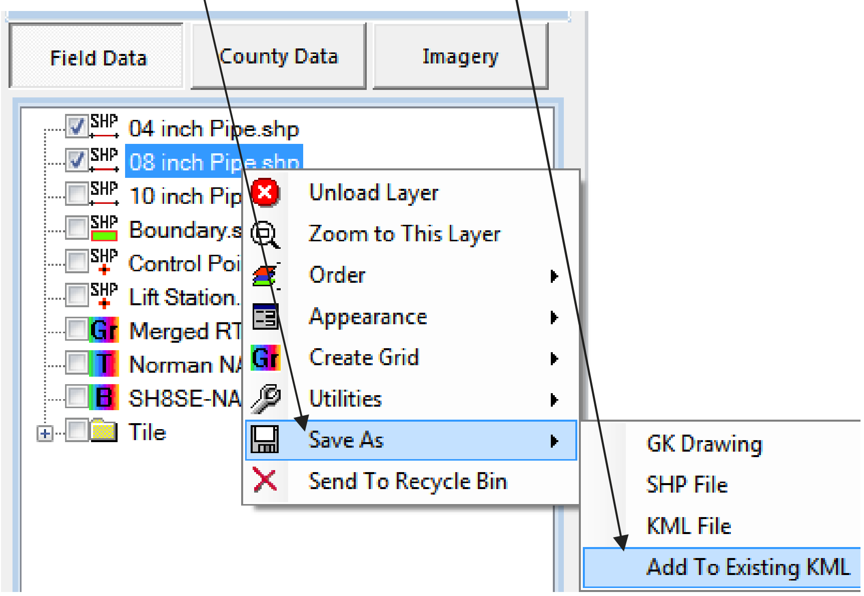
Exporting KML Files For Google Earth ™

Adding to KML files

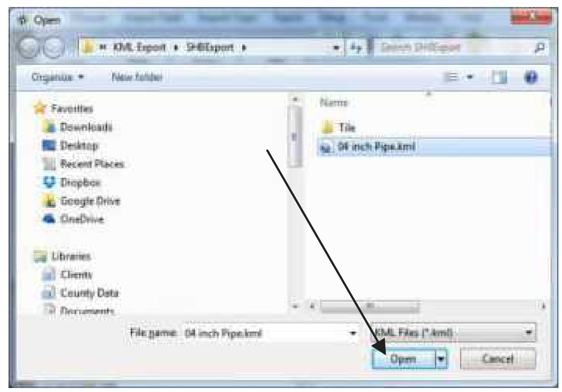
There are times when you may want to add additional types of vectors to an existing KML file. These could include boundaries, different pipe sizes, or any other shapefile. This can be done using a similar process as saving them individually.



1. Turn on the SHP file to add to the existing KML file.
2. Right click on the file to add and select:
   - Save As ► Add To Existing KML

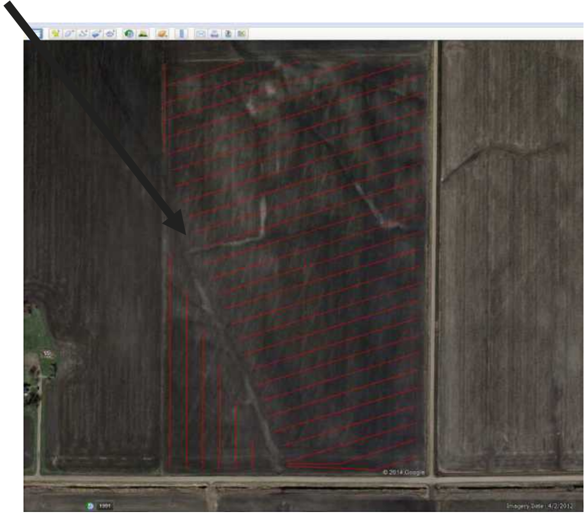


3. Browse to the location of the existing KML file.
4. Click “Open.”
5. The file is now saved to the existing KML and can be opened in Google Earth.



This processes can be repeated as many times as necessary to combine all of the files.

Notice the mains have been added into this file.



Quick Notes For Topography—RTK

Importing Topography Data - RTK

1. Open into **"Map Window".**
2. **"Import"** – (Select the file type you want to import (ex-JD-GS2)
3. Select the folder location - **"Select Card Path"**
4. Check all the files to "Import"
5. Click "**Process Selected Files**.
6. All the files will go to the "Client" "Farm" "Field" structure just like you had them in the GS2 Display

Creating Boundary

1. Select the desired Client, Farm and Field.
2. Turn on the elevation points first, then the county NAIP.
3. **To Create Boundary from CLU** – turn on the "County CLU.shp" and make sure it's the **active layer**.
4. Click on the **"Select Mode Replace"** button and click inside of the correct CLU boundary (to select multiple, hold down "Ctrl").
5. The boundary will appear **Lime Green**
6. Click **"Save Selected Objects"** top toolbar, Name, Save.

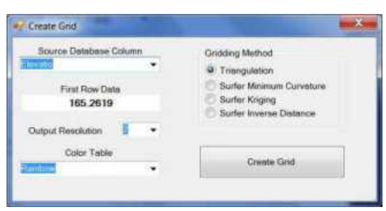
——— OR ————————————————————————————-

3. **To Hand Draw a Boundary** - Click the **"Create New Layer from Template"** button and select **"Boundary"** from the list.
4. Check the **"Boundary.SHP"** Boundary.SHP file to turn it ON & make sure it is the **active layer on the bottom toolbar**.
5. Select **"Draw New Object"** button on the bottom toolbar.
6. Draw the boundary by "Left Clicking" around the field (hold down the "Alt" key and "Left Click" to undo points) and "Right Click" to finish.
7. Click **"Save"** on the bottom toolbar.

Cleaning Up Elevations

1. Turn on the Elevation Points (CSV or SHP)
2. Click on the **"Database"** - Bottom Left Corner.
3. Click on "GPS Status" Header descending (Click again-ascending)
4. Look at the Data and select points to delete – if needed – (delete VDOP & HDOP greater than 3 / GPSAccV greater than 13)
5. Click on the **"Delete Selected Objects"** on the bottom toolbar.
6. Click **"Save"** or **"Save As"** on the bottom toolbar (If "Save As" rename EX.-Topo-Cleaned-2008.shp).
7. Go to "Layer Info" & "CLEAR MAP"

Create Grid Map



1. Check on the "Elevation.shp" Point file.
2. "Right Click" the name "Elevation.shp.
3. Select **"Create Grid"**
   And **"Create Grid from Points"**
   Adjust your settings like this
4. "Column Name Mapping"
5. Click "**Create Grid**"
6. Go to "Layer Info" & "CLEAR MAP"

Crop to Raster

1. Turn on Boundary and select **"Select Mode Replace"** off of the top toolbar.
2. Click inside the Boundary polygon making it **Lime Green**
3. Turn on "ElevationRTK.grd" and select **"Crop Raster to Selected Polygon"**
4. Click "Save" on the bottom toolbar
5. Clear Map

Create Watersheds

1. Make sure **"Elevation-RTK.grd"** is checked on.
2. On the Top Toolbar select **"Process"** & **"Watershed Modeling"**
3. In the "Create Watershed Layers"
   Topo Source "Elevation-RTK"
   Units in "Feet"
   Flow Density 40 (usually)
4. Click "Create Watershed Layers" (auto saved)

Create Contours

1. Create Contour Layers – set "Break Points" to "1.0"
2. Click"Create Contour Layers"
3. FINISHED......

Quick Notes For Topography—LiDAR

Creating Project Boundary

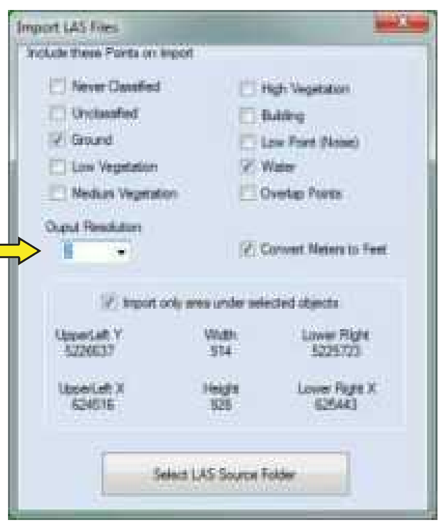
1. Select the desired Client, Farm and Field.
2. Turn on your County Data
3. **To Create Boundary from Sections** – turn on the "County Sections.shp" and make sure it's the **active layer**.
4. Click on the **"Select Mode Replace"** button and click inside of the correct Section boundary (to select multiple, hold down "Ctrl").
5. The Section will appear **Lime Green**
6. Click **"Save Selected Objects"** top toolbar, Name, Save.

——— OR ———————————————————————————-

3. **To Hand Draw a Boundary** - Click the **"Create New Layer from Template"** button and select **"Boundary"** from the list.
4. Check the **"Boundary.SHP"** Boundary.SHP file to turn it ON & making it the **active layer on the bottom toolbar**.
5. Select **"Draw New Object"** button on the bottom toolbar.
6. Draw the boundary by "Left Clicking" around the field (hold down the "Alt" key and "Left Click" to undo points) and "Right Click" to finish.
7. "Save"
7. Click **"Save"** on the bottom toolbar.

Importing LiDAR

1. Turn on "Boundary.shp" **active layer on the bottom toolbar**.
2. Click on **"Select Mode Replace"** button and click inside the Polygon. (Polygon will appear **Lime Green**)
3. Go to "Import Topo" and select "LIDAR LAS Import"
4. Make sure you are checked on
   - Ground
   - Water
   - Convert Meters to Feet
   - Import only area under selected objects.
5. Output Resolutions = **2** meter
6. Click "Select LAS Source Folder"
7. Choose the Correct Folder
8. Click "OK"



Create Field Boundary

1. Turn on the "LidarImport.grd"
2. Zoom to the field.
3. Click on "Create New Layer from Templates" Choose "Boundary"
4. Select "Draw New Object" from the bottom toolbar.
5. Draw a new field boundary to represent the "Drainage" of this field.

Note: This boundary is usually "Smaller" than the fields tillable acres.

6. Save the "Boundary.shp" on the bottom toolbar.
4. Go to "Layer Info" & "CLEAR MAP"

Crop to Raster

1. Turn on Boundary and select **"Select Mode Replace"** off of the top toolbar.
2. Click inside the Boundary polygon making it **Lime Green**
3. Turn on the "LidarImport.grd" and select **"Crop Raster to Selected Polygon"**
4. Click "Save As" on the bottom toolbar
5. Name "LidarTopo.grd"
6. Click on "Crop Null Values"

Create Watersheds

1. Make sure **"LidarTopo.grd"** is checked on.
2. On the Top Toolbar select **"Process"** & **"Watershed Modeling"**
3. In the "Create Watershed Layers"
   Topo Source "LidarTopo"
   Units in "Feet"
   Flow Density 40 (usually)
4. Click "Create Watershed Layers" (auto saved)

Create Contours

1. Create Contour Layers – set "Break Points" to "1.0"
2. Click"Create Contour Layers"
3. FINISHED……

Creating Topography & Watersheds

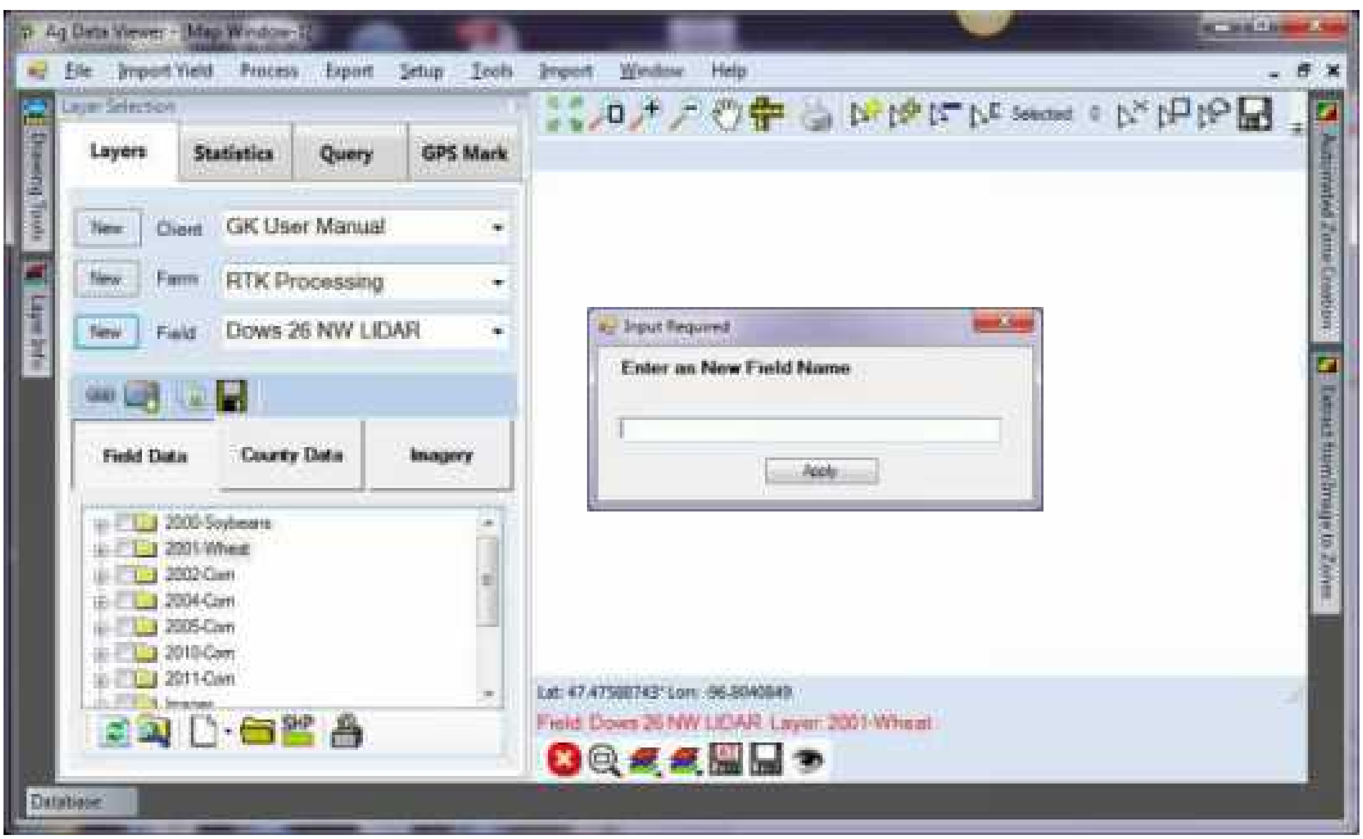
This section of the help guide we will be looking at extracting topography data, cleaning, merging and turning the point files into surfaces. Once the topography surfaces are created, it will be processed in the Watershed Modeling, creating a series of water management layers.

Start up Ag Data Mapping Solution and select the **"Map Window"**  button.

Creating: GROWER - FARM - FIELD

1. When the "**Map Window"** opens up, select the desired "Grower", "Farm" and "Field". If they do not exist, click on the "**New**" buttons to the left of the name. An "**Input Required"** window will open up in the middle of the screen to enter the new name, do so and click **"Apply".** Now the desired field is selected.

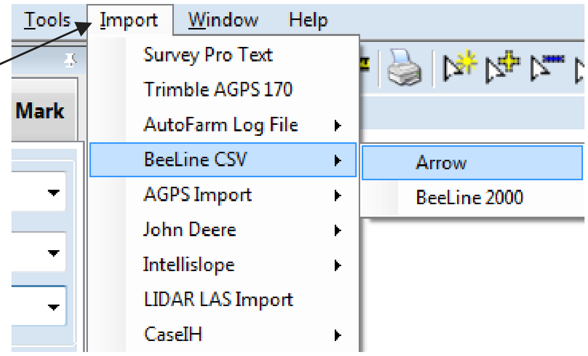
2. When selecting "Grower" make sure to select the "Farm" & "Field" also.



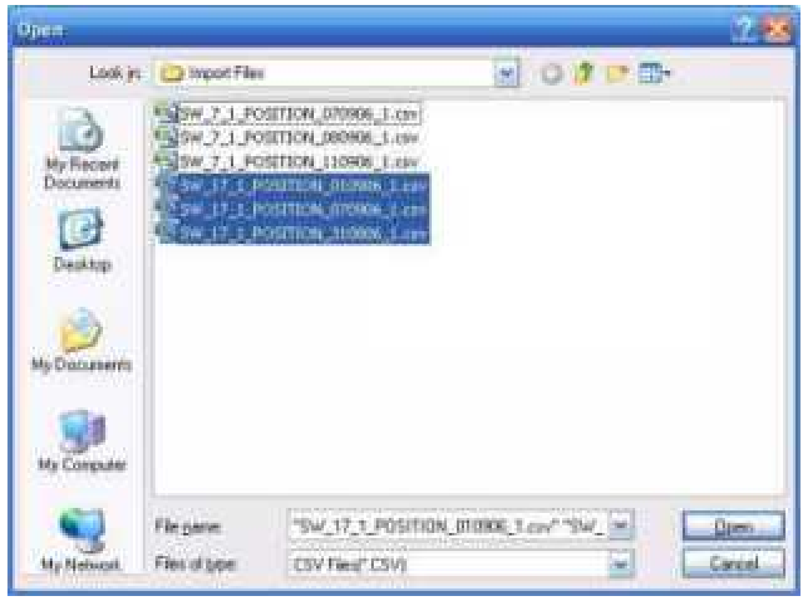
Creating Topography & Watersheds

Importing Data

Once selected to the desired "Field", select **"Import"** from the menu and choose the source where the files were created.

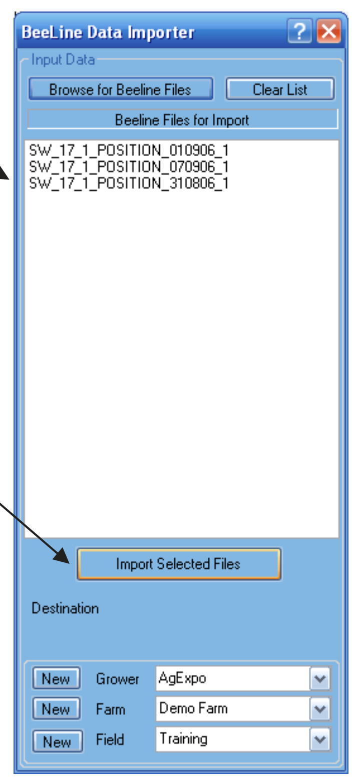


Next, "Browse" to the desired files or select where the data is stored.



Select the desired import files.

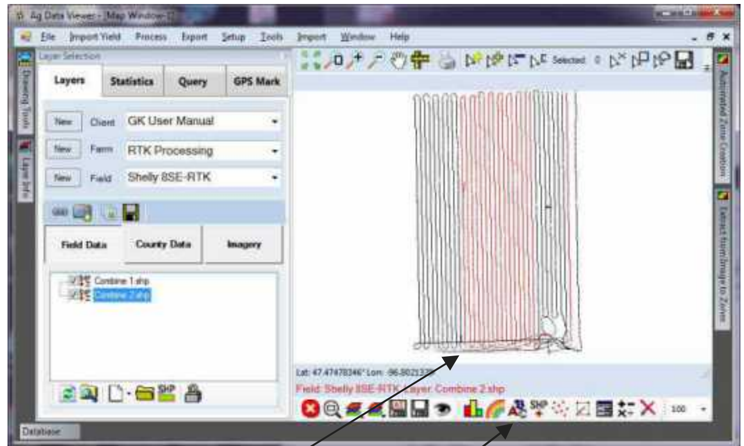
Select the desired destination Grower – Farm – Field. (Note: some imports are automated by the "Names" used at the collection time).



Click the **"Import"** button.

Creating Topography & Watersheds

Adjusting levels between multiple "Point" SHP files



Many times there is a need to combine data from multiple SHP files to make one dataset for surfacing.

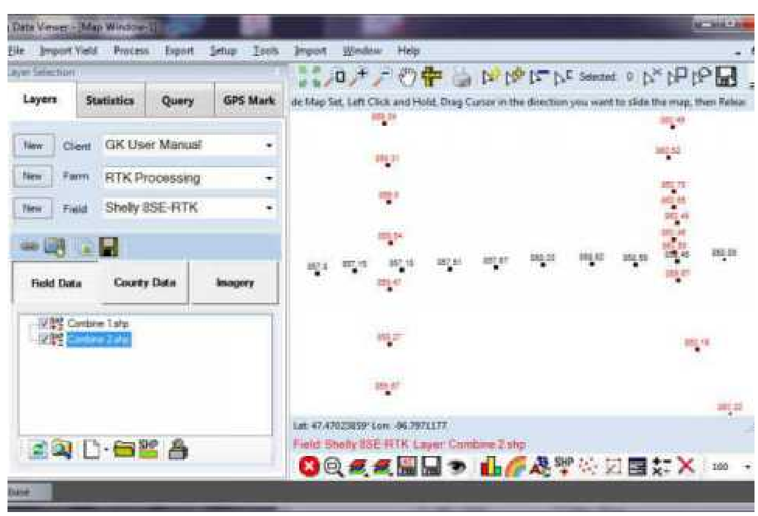
In the example to the right, we have turned on two shapefiles and changed the color of one of them to blue. In order to make this into one SHP file for surfacing, the two files must be merged.

If the two files were collected by different machinery, or from different base points, there may be a need to adjust one of the files up or down to match the other. And there may also be some bad points to filter out of the data.

Essentially, what we are looking to do is find areas where the point files overlap each other. Then find points very close in elevation to each other and check the elevation values between them. The arrow points to the areas that overlap between these two shapefiles.

To add Labels to Points:

- Select "Combine2.shp" in this example making it the Active Layer.
- On the bottom toolbar, click the **"ABC" "Change Label Settings"** Button
- In the "Labels" window, change the **"Source Database Column"** to the column that contains the elevation values.
- Set "Label Height" to 1 or 2 feet.
- Set the label color of each data set to different colors (Example Red & Black)
- Click Apply



After applying labels to each of the SHP files, you can zoom in on the overlap areas and find points close to each other and check the elevations between the points. Look for any large differences. Keep in mind not to get too picky, standard error of an RTK receiver is 0.16 feet.

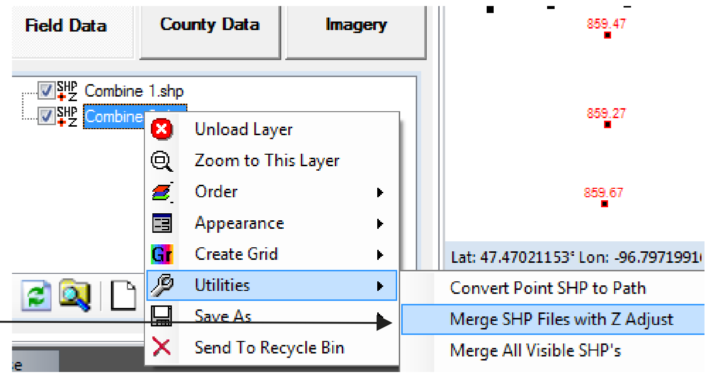
We suggest taking five or more readings and use an average difference. (Consider putting #'s into Excel) Ex. 860.59 - 858.46 = 2.13' difference

Creating Topography & Watersheds

Merge SHP Files with Z Adjust

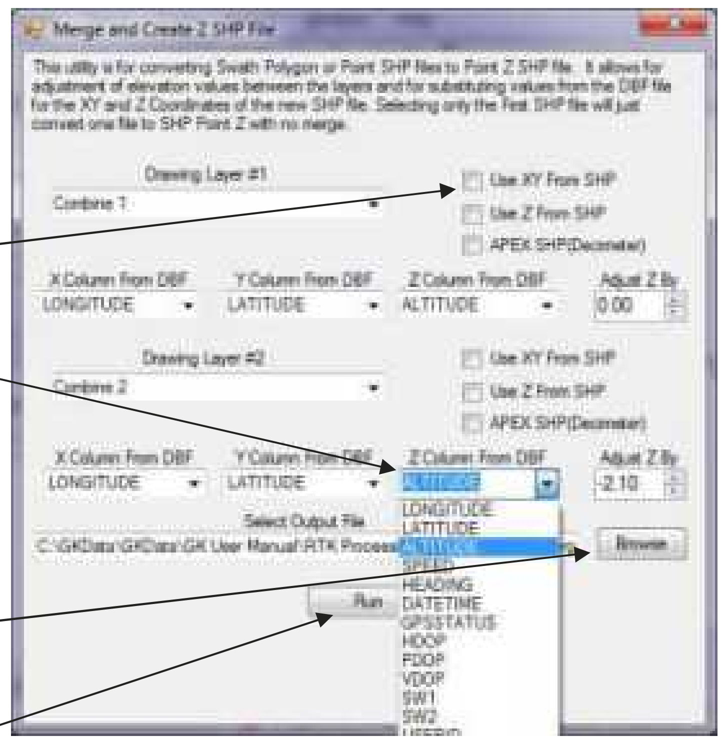
When you have two layers of different elevations that need to be put together, the **"Merge SHP files with Z Adjust"** will take care of the problem. *(Do Not use on Yield Data)*

1. Make sure that both the layers are turned on and you have done the math to know how much you will have to move the given layer up or down.



2. "Right click" on the file name in the data tree, and select **"Utilities"** and **"Merge SHP Files with Z Adjust"**.

3. The **"Merge and Create Z SHP File"** window is now open. Select the two input layers using the dropdown arrows on Drawing Layer #1 and #2.



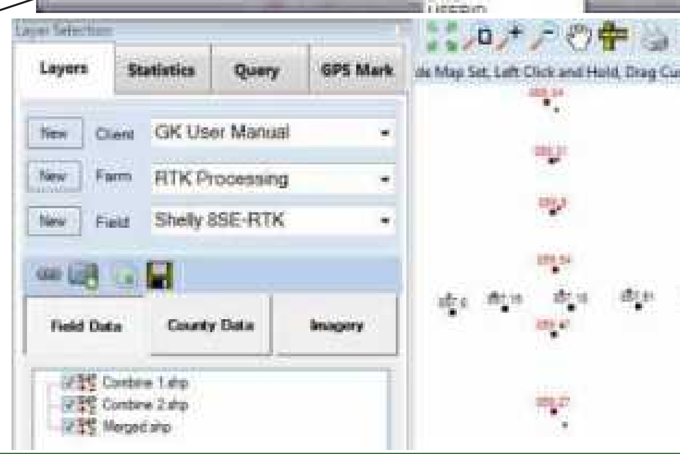
4. Once you have selected the input layer, the "X Column From DBF" should say LONGITUDE and the "Y Column From DBF" should say LATITUDE. If the "X" and "Y" are empty and you do not find these pieces of information under the dropdown arrows, select the **"Use XY From SHP"** box. This will apply the Lat/Lon from the given object (imbedded into the code of the object).

5. Next select the dropdown arrow under the **"Z Column From DBF".** There should be a piece of data about Elevation or Altitude.

6. Next, in the **"Adjust Z By"** box, enter the value for the object you want to adjust up or down. You should only enter a value for one object (either Drawing 1 or 2).

7. **"Browse"** to the desired output location, and save the file as a new and identifying name, such as **"Merged_Topo".**

8. Click the **"Run"** button and this will merge these two SHP files together.



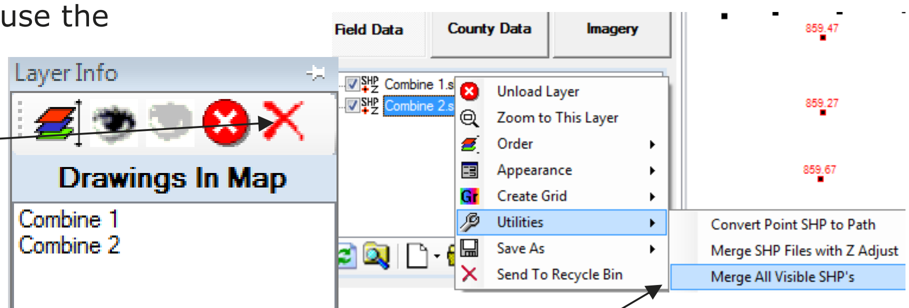
Continue to "creating the topo map".

My Notes

Creating Topography & Watersheds

Merge All Visible SHPs

When multiple layers of SIMILAR elevations or SIMILAR yields need to be combined, use the **"Merge All Visible .shp's"**



1. Start by going to **"Layer Info" & "Clear Map".** *(This is to verify that only the desired layers are selected since multiple layers can be merged at one time with this tool).*

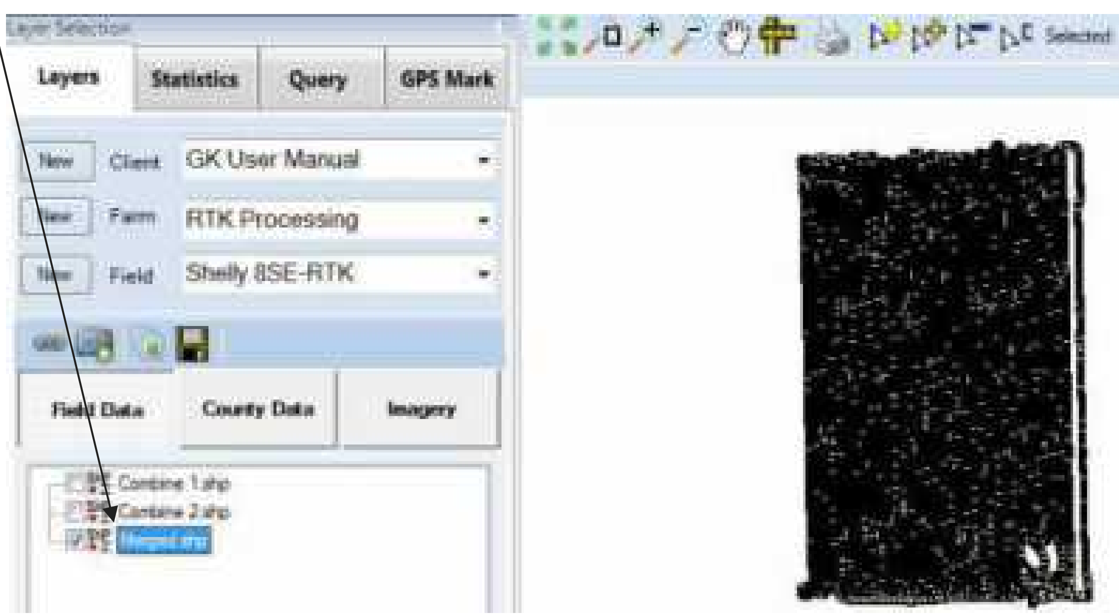
2. Next, turn on all layers to be merged (***word of warning***: *do not turn on any back-ground "drawings" such as roads, sections and etc. They are shapefiles and will cause an error on the file merge).*

3. "Right click" on any of the files to be merged and select **"Utilities"** —> **"Merge All Visi-ble.shp's**".

4. This will bring up a **"Save As**" window. Make sure to create a new & identifying name for this object such as "**Merged**".

5. There will now be a new file in the Data Tree named **"Merged".**

Continue **"creating the topo map".**



Creating Topography & Watersheds

Cleaning Elevation Data—Database Tab

In most cases I wait till all my data sets are merged before cleaning, it makes for only 1/2 the work. In some cases, you may need to clean the data up before merging, but this is rare.

Before getting going, understand that not all RTK Data collection equipment collects data the same way. Some will "log" Quality information and some will just log Lat/Lon/Elevation. A good system will log additional Quality information.

Turn on your complete data collection for the field (again all the data should be in 1 SHP file).

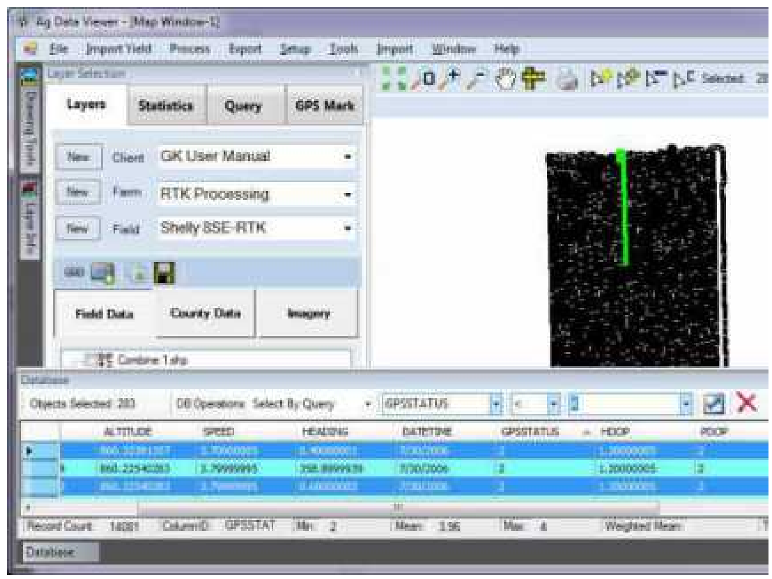
2. Click on the "**Database**" tab Bottom Left, the data table will open up.

3. By clicking on the column "names", you will be able to sort the data ascending or descending. This is very useful for "deleting" unwanted data. By clicking on the gray area to the left side of the rows, you will be able to select objects within the active layer. By using the "Shift" key you can select multiple rows of data. You can also use the "Ctrl" key to select multiple points.

4. When working with Topography data, there are usually columns for signal correction or signal quality. You need to find out what values are acceptable for your application and use this "Table" to delete unwanted or invalid points.

5. There is also a "**DB Operations—Select By Query**" function. By using this, you can choose <>= functions to help select values to delete. Choose or type in a value to query & Click "**Run**". ` Delete unwanted Points

6. Save the edited layers. You can either save them as the same name you imported them and you will have to re-import them if you want to see or use any of the deleted data, or name the file with a "New File Name". This allows the user to come back and look at the "original" data again at any time.



Columns to Cleanup & Suggestions

HDOP	Delete anything greater than 3.0
VDOP	Delete anything greater than 3.0
RTK	Use ONLY RTK FIXED Data
	RTK Extend or Float = DELETE
GPSAccV	Delete anything greater than 13

There are many more column names and values. Generally delete out data that indicates the potential for vertical error over...

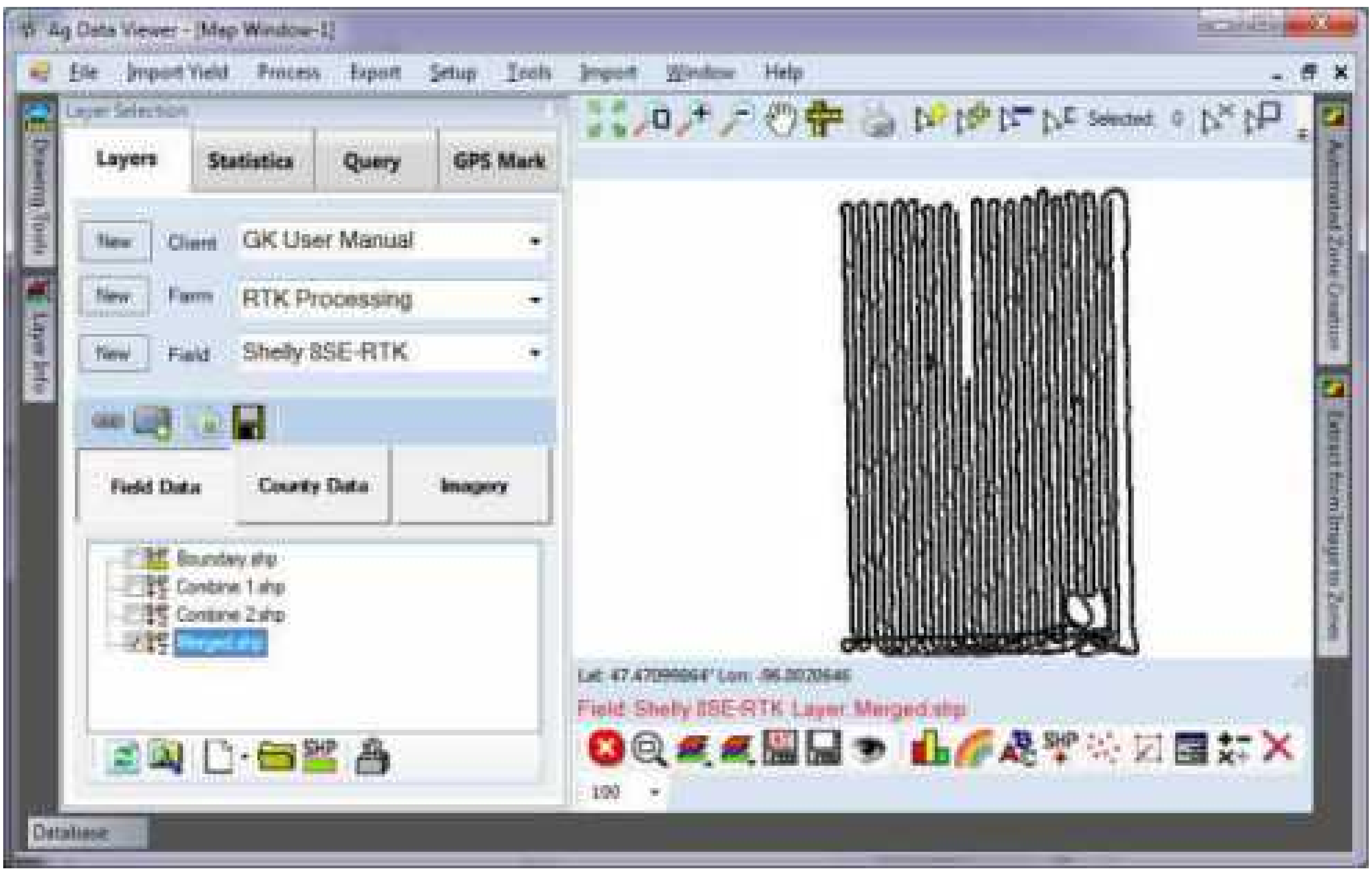
0.4 foot
5.0 inches
0.13 meters

Creating Topography & Watersheds

Creating the Topography Map

Set Up the Input Data

The input data required for creating a topography map is a point SHP file with elevation data and a field boundary. Place this data in the Field Folder, using Windows Explorer, or export it to this location with other software. Then in Ag Data Mapping Solution, open a new map window and check the file to display it.



Creating Topography & Watersheds

Creating the Topography Map

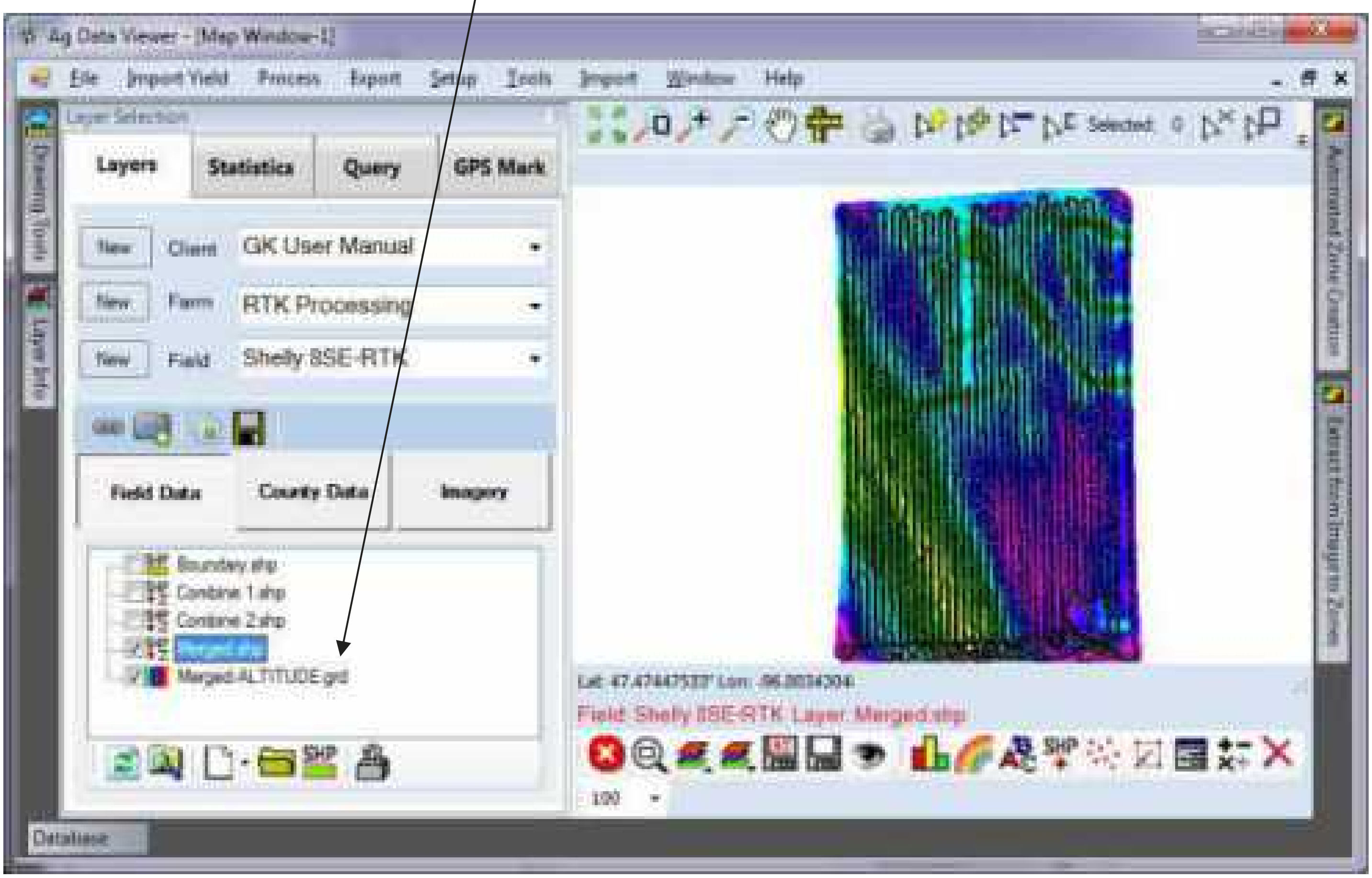
Grid the Points

"Right click" on the shapefile that you just turned on and click **"Create Grid"** —> **"Create Grid from Points"**.

In the dropdown box labeled **"Source Database Column",** select the column that contains the elevation data. In this case it is labeled **"Altitude".**

A progress bar will run as the new layer is created. The new file will be created in the same directory as the point SHP file with the name of the database column, the last three letters will be .grd".

Refresh the tree and check the box to display the new grid.



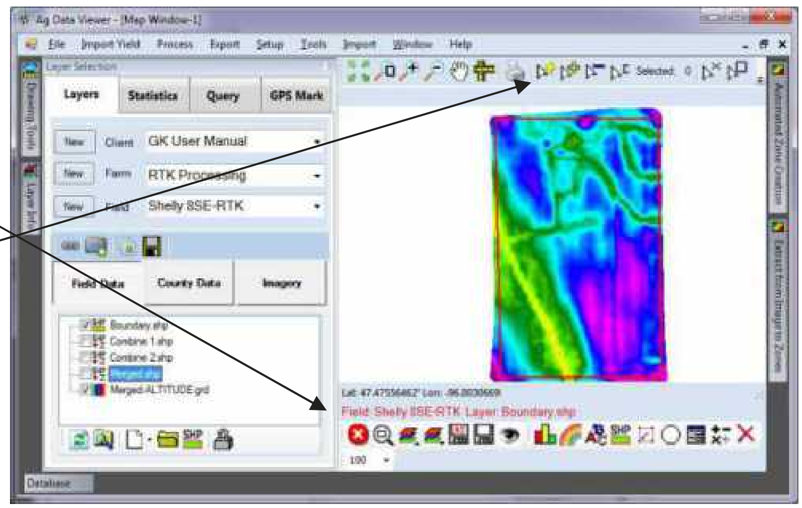
Creating Topography & Watersheds

Creating the Topography Map

Select the Boundary

Check the box next to the field boundary to turn it on. Then using the selection tools on the main menu, select the boundary to be used to crop the image.

Field Boundary Not Selected



1 – Check the **"Boundary"** button in the data tree.

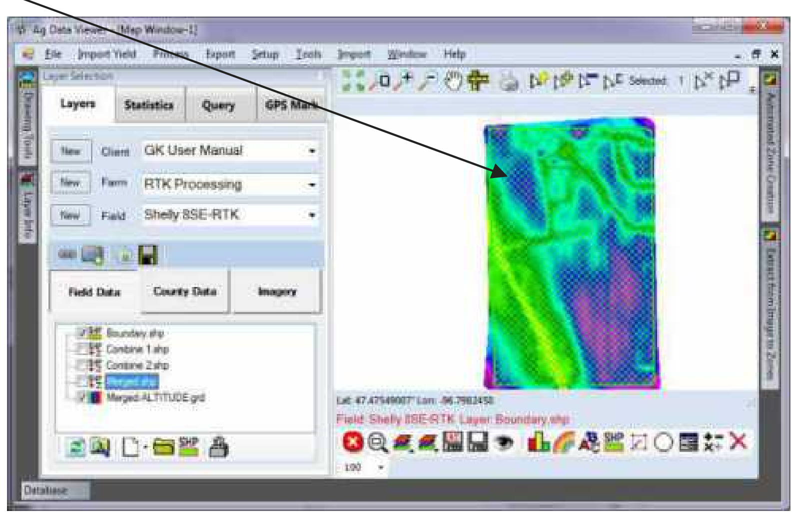
2 – Make sure the "Active Layer" address line say **"Boundary.shp".**

3 – Make sure the **"Select Mode Replace"** button is selected or turned on.

4 – Place the mouse cursor inside the field boundary and "left click".

5 – Take note of the **lime green** cross hatching (indicates that the boundary has been selected).

Field Boundary Selected



Note: The crosshatching will disappear on the next redraw or movement of the images on the screen leaving a **lime green** boundary showing it is selected. GK Tech does not recommend using lime green for a color setting for any other layers for this reason.

Creating Topography & Watersheds

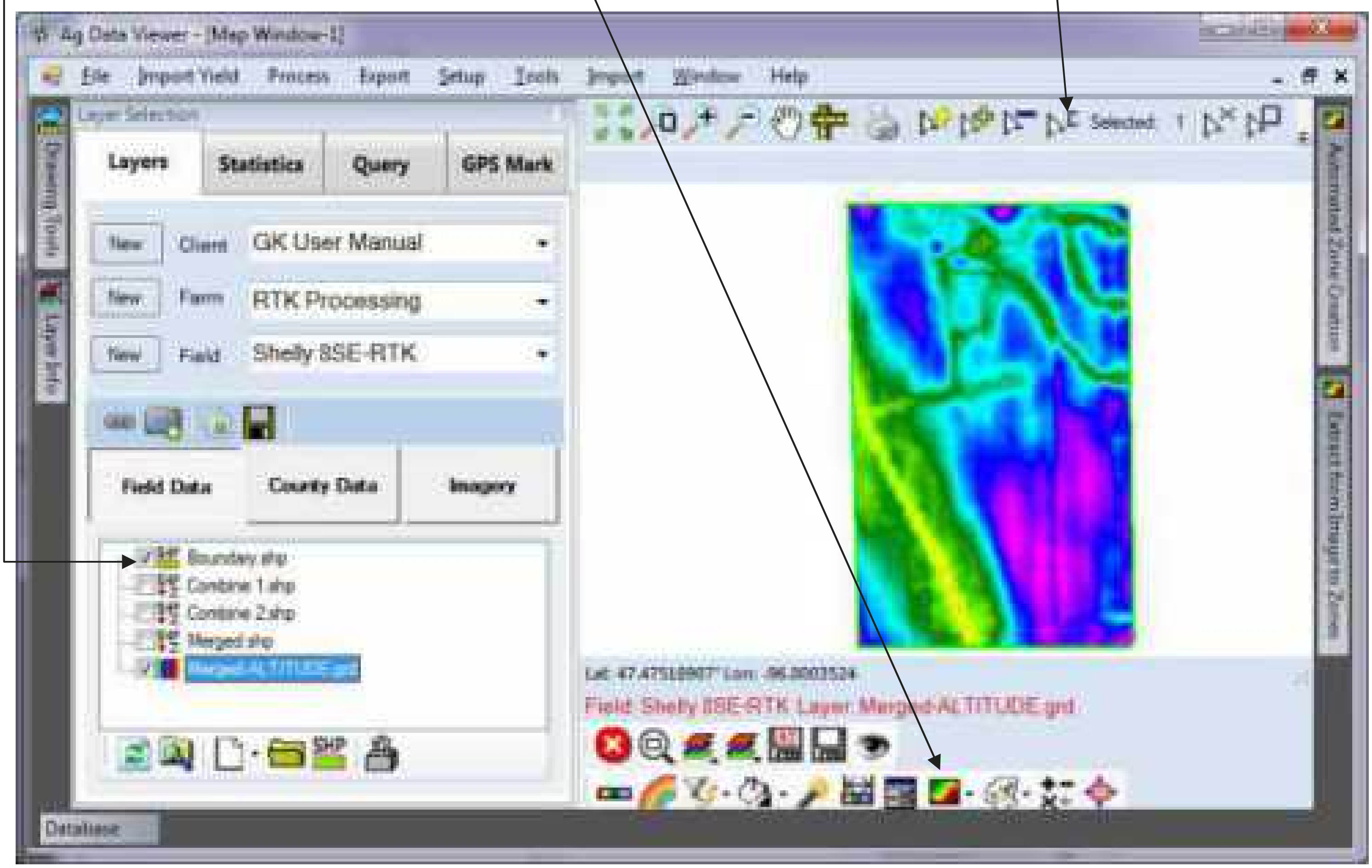
Creating the Topography Map

Cropping the Grid to a Boundary

After you have selected a boundary, then click on the **"Topography Grid File"** in the data tree, to make it the current layer. On the **"Layer Tool Bar"** at the bottom of the screen, click the last button with a tool tip of **"Crop Raster to Selected Polygons"**.

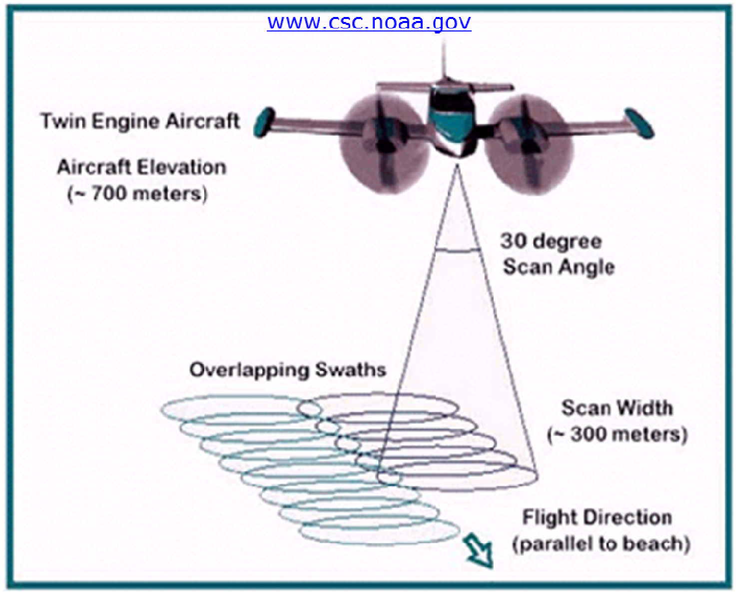
This will crop the raster, then click the **"Save"** button on the layer toolbar to save the changes to the grid file.

Then click the **"Clear Selection"** button to remove the **lime green** crosshatch if needed.



LiDAR—General Info

LiDAR = Light Detection And Ranging



LiDAR is collected by a plane shooting a NIR (Near Infra-Red) laser at the earth and measuring the reflectance time back to the plane.

Flight Info—

- Plane is equip with RTK & Data collection PC
- Equip with special LiDAR sensing tools
- High winds & gusts cause inaccurate readings
- Flight Elevation (approx.) ~ 2,300'
- Pass Width (approx.) ~ 985'
- Flight Speed (approx.) ~ 100-200 mph

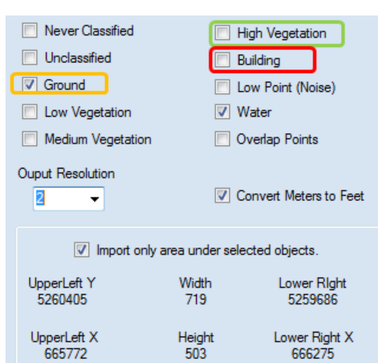
LiDAR may be an excellent topography data source in many cases. Typically it is going to be a 1 time collection event in most areas, and it has some limitations we need to understand. It is important to have a good idea of when (year) the data was flown. LiDAR is typically collected at times of minimum vegetation (Fall—Winter—Spring)

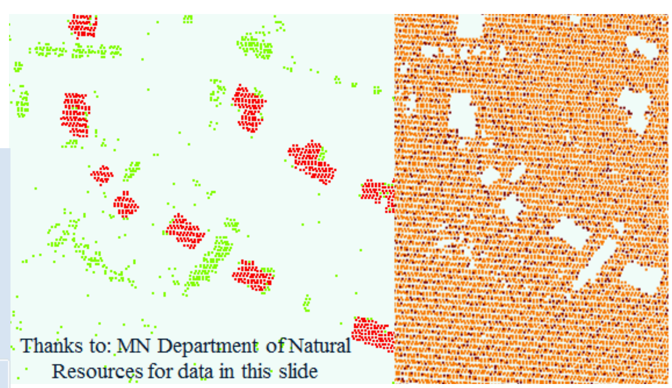
LiDAR Facts—

- Elevations at the top of dense vegetation (cattails, heavy grass & weed patches)
- Reads the tops of buildings and structures
- Reads the elevation of the surface of water or snow
- Accuracy in tree covered areas are always questionable (density of trees & organic matter on the ground)
- Road ditch bottoms are always questionable due to the previous points
- Know the year of LiDAR collection (useful for surface drainage changes or standing water)
- Know the "accuracy" rating for your LiDAR data. MN, ND, SD, rated at 8" accuracy and the Red River Valley MN-ND at 6" accuracy.
- Every LiDAR reading gets classified (suggest using Ground & Water for drainage in ADMS)

GK Technology's preferred LiDAR data type is LAS file

- *UTM coordinate*
- *X&Y units =METERS*
- *Z units = Feet or Meter*





LiDAR—Registering “laszip.exe” LAZ Extractor

LiDAR data comes in a variety of different formats. ADMS software prefers the data to be in a LAS format. We can also work with LAZ formats. Basically the LAZ format is a “zipped” or “compressed” format, that takes up much less space. On average the LAZ is 1/10th the size of the LAS file. You can store your data as LAS or LAZ, we suggest choosing one file format per folder for faster processing.

We suggest saving all your LiDAR data (LAS or LAZ) to a single “Lidar” folder in your “GKData/ Imagery” folder. If you are covering large areas, we suggest creating a “county folder” in the “Lidar” folder structure.

LAS—files are ready to be used by the software.

LAZ—files need to have an “Program registered” to extract them.

Registering LAZ extractor program

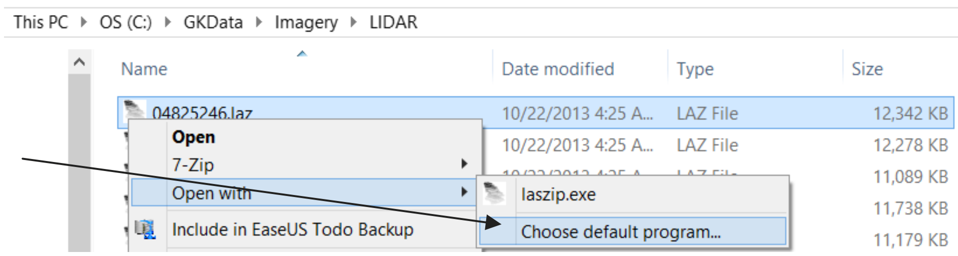
If you are running ADMS v 7.1 or newer you will find a file called laszip.exe in your C:/GKData/ _DB/lastool Folder. (*If you don’t find this file, contact your ADMS support staff*).

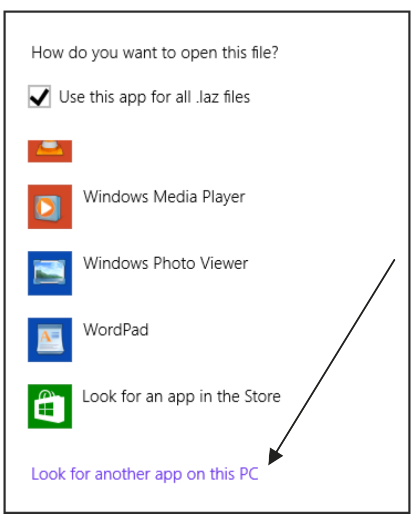
Go to your C:/GKData/Imagery/Lidar folder (or the location where you have your LAZ files).

“Right Click” on a LAZ file

Choose “Open with”

“Choose Default Program”



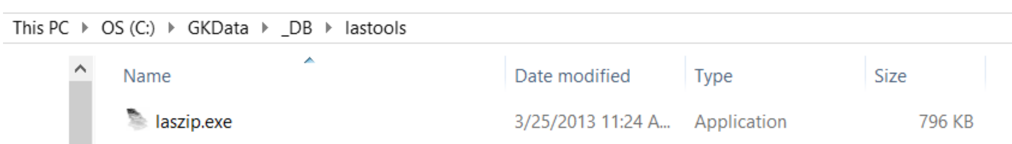


In the “How to open” window

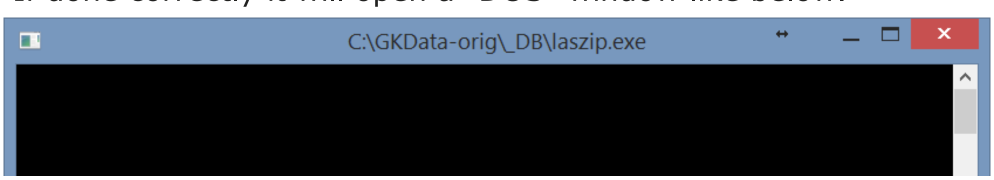
⇒ Choose “More options”

⇒ “Look for another app on this PC”

Browse to C:/GKData/_DB/lastool Folder and select the “laszip.exe”



If done correctly it will open a “DOS” window like below.



Creating a xxxxxx.las file in the “Lidar” folder

From here on out the software will automatically convert the LAZ to LAS to create your LidarImport.grd files. You DO NOT need to UNZIP the LAZ files in the “Lidar” folder, saving space.

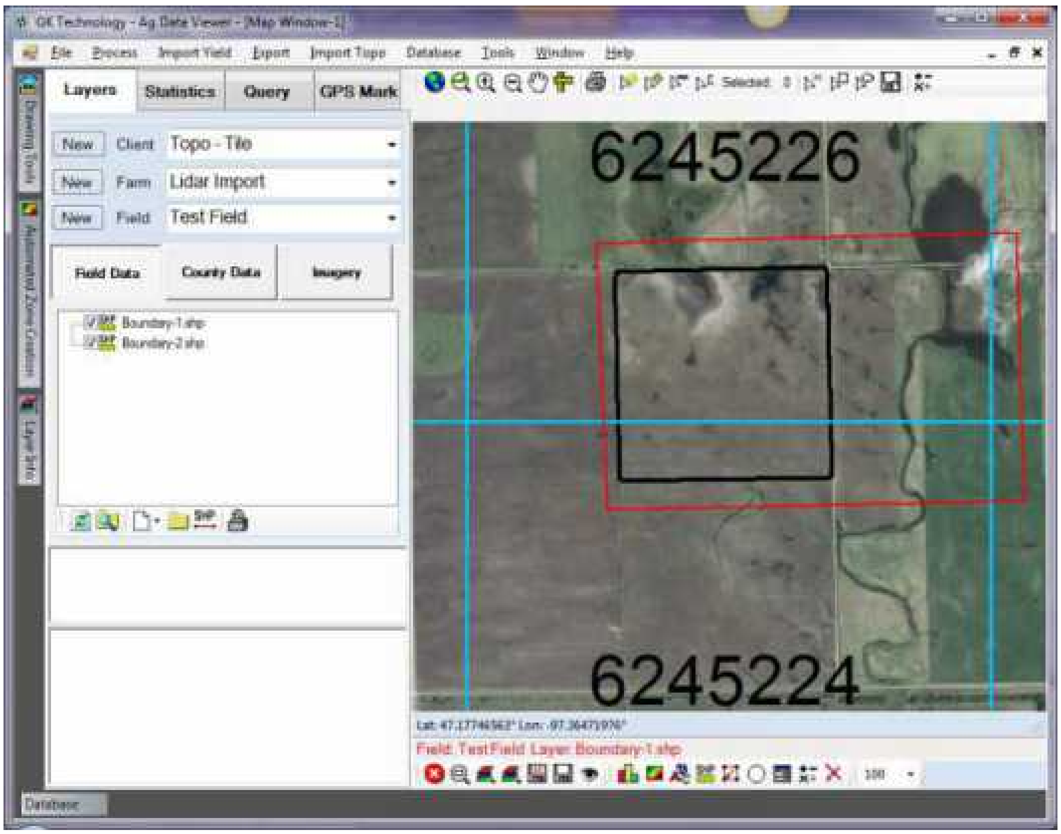
Processing LiDAR LAS Files

To utilize the "LiDAR" data you have downloaded. (See Downloading LiDAR)

1. Draw boundaries to define the areas you want to process.
   You may want to have two boundaries created.

Boundary 1—Field Boundary—This polygon will define the field (or section) and will be used for running your watershed modeling. Keep in mind the accuracy of this boundary will affect the "Flow Accumulations", "Depressions" and "Watersheds".

Boundary 2—Tile Area—This polygon will encompass the whole field area and also the potential tile "Outlet" area. This object will not be used for watershed modeling.



Field Boundary in Black

Tile Area Boundary in Red

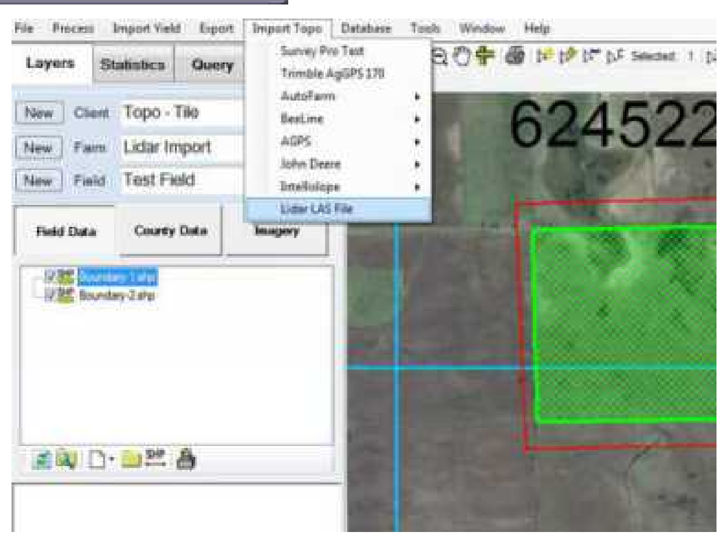
Lidar Tile Boundary in Blue

For this example we have only downloaded LiDAR tiles 6245226 & 6245224

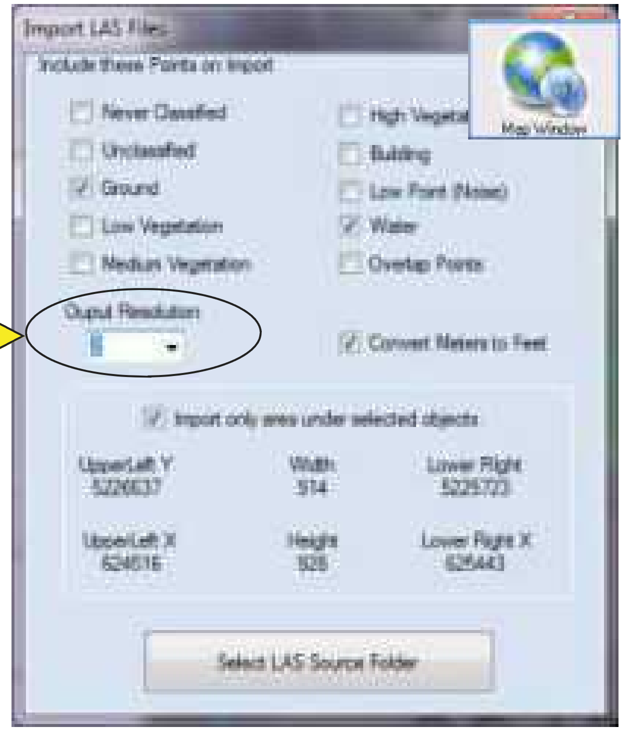
If we had the tiles to the East they would have filled in the rest of the Tile Area.

2. To "Import LiDAR" you must turn on the "Boundary" and "SELECT" it.
   The Boundary will become ***LIME GREEN***

3. Go to the "Menu Bar" & click on "Import"
   Select "Lidar LAS File"



Processing LiDAR LAS Files



4. **Import LAS Files**—Adjust your settings to...

    Default should be correct
    Check—Ground
    Check—Water
    Check—Convert Meters to Feet
    Check—Import only area under selected objects.

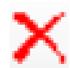
    Default is 1 meter should adjust
    Output Resolution = 2 meters

    Resolution settings
    Less than 40ac— 1 meter
    40ac to 2500ac—2 meter
    2501ac to 9000ac—3 meter

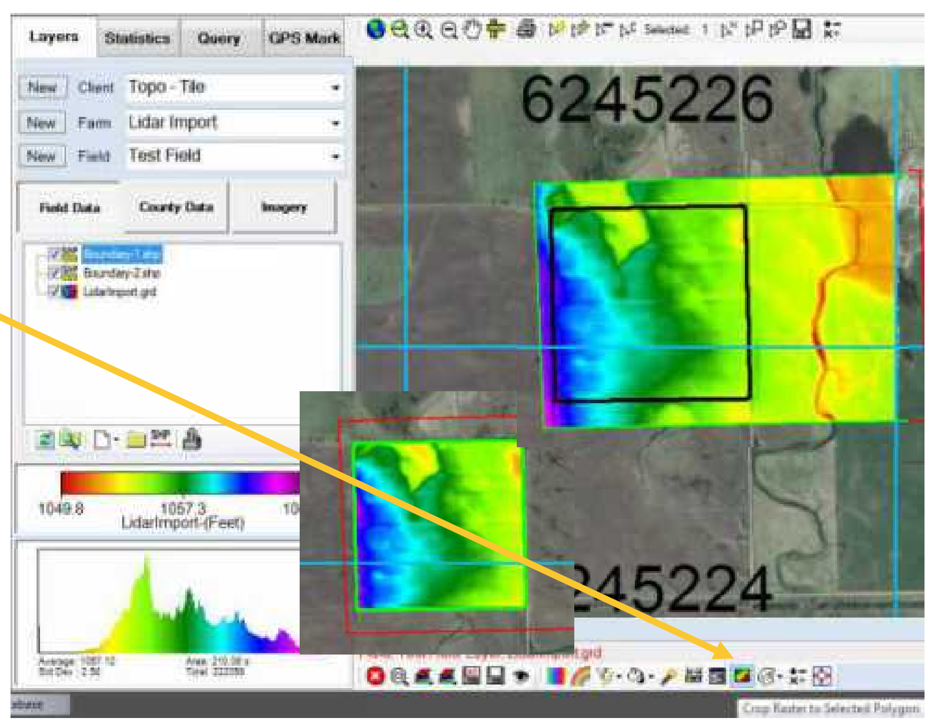
5. Click on the "**Select LAS Source Folder**"
    Browse to the "Folder" containing the "LAS" files

    Should be in C:/GKData/Imagery/LIDAR
    OR C:/GKData/Imagery/LIDAR/countyname

6. Click "**OK**" and the LiDAR tiles will be processed to the "Selected Boundary" Large Boundary.

7. Go to "**Layer Info**" & "**Clear Map**" 

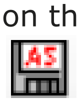
8. Turn on the "Field Boundary.shp" (you may want to re-draw at this time)



9. Left Click inside Field Boundary — it will turn **Lime Green**

10. Turn on "LidarImport.grd"

11. Click "**Crop Raster to Selected Polygon**" on the Bottom Toolbar "**Just this Layer**" 

12. Click "Save As" on the Bottom Toolbar 

13. Rename and click "Save"
    We suggest renaming to "LidarTopo"
    "Lidar Field.grd"

Creating Topography & Watersheds

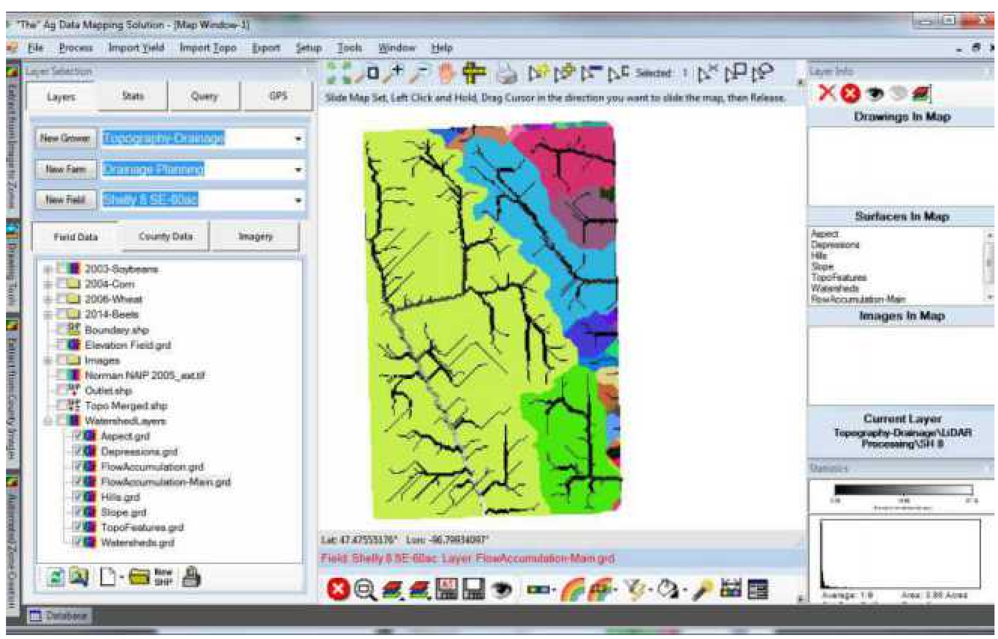
Creating the Topography Map

Running the Watershed Modeling Routine

Open into the "Map Window"

- Select the desired "Client", "Farm" and "Field".
- Turn on the "Altitude.grd" or "Lidar.grd" for the field
- Top Tool Bar select "Process" and "Watershed Modeling"

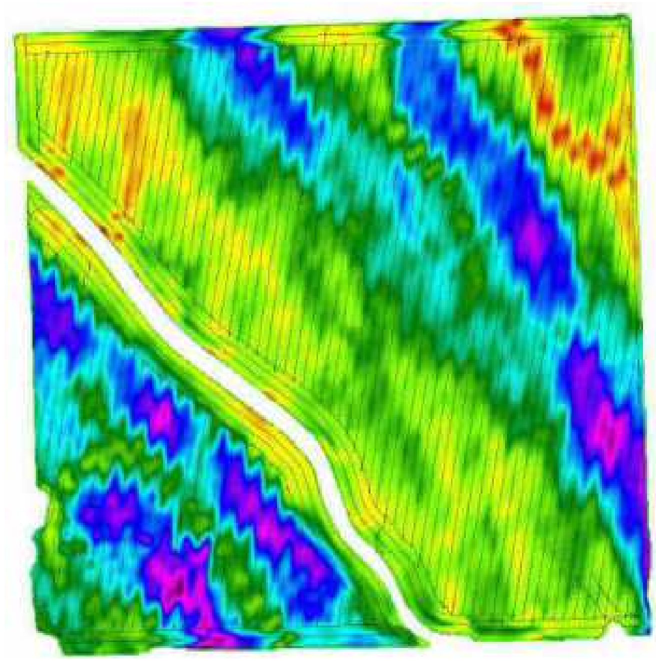
1. In the "Select Topography Source" drop down, select the layer that was created in the "Grid Points" method on the previous page.
2. In the "Elevation Unit" drop down box, select whether the input data for the elevation surface is in feet or meters. This setting is necessary for computing the slope of each cell in the field. The horizontal units are in meters, by defining whether the units are in feet or meters, the % slope is calculated correctly.
3. For a starting point, leave the "Flow Density" set at 50. This number can be raised or lowered, to provide more or less detail in the flow accumulation layer.
   Raising this number provides more detailed flow paths.
4. Click **"Create Watershed Layers"** in the "Create Watershed Layers" Frame:
5. When the progress bars disappear, a view like the one below will be displayed. That view is the flow accumulation layer over the top of the watershed's layer.
6. The flow paths should make sense to you when you look at them. If they do not, there may be some false data in the topography layer that is not representative of what is happening in the real world. Looking at the depressions layer to see if the areas defined as concave "bowl" shaped areas in the field are correct will help to determine if the data is correct. Excessive area showing up in the depressions layer may indicate that an outlet for water was not represented correctly in the topography map.



Using the Point Offset Routines to Adjust for Better Topography Maps

Some GPS data logging packages use an offset while collecting data. This is visible in planting data from both Deere and Ag Leader.

While it makes sense for the planting data, the altitude attribute that is written to the file is for the altitude at the GPS receiver, not at the planter. And a topography map with the appearance of the one to the right is the result. Note the zippered appearance of the edges of all of the features of the maps.

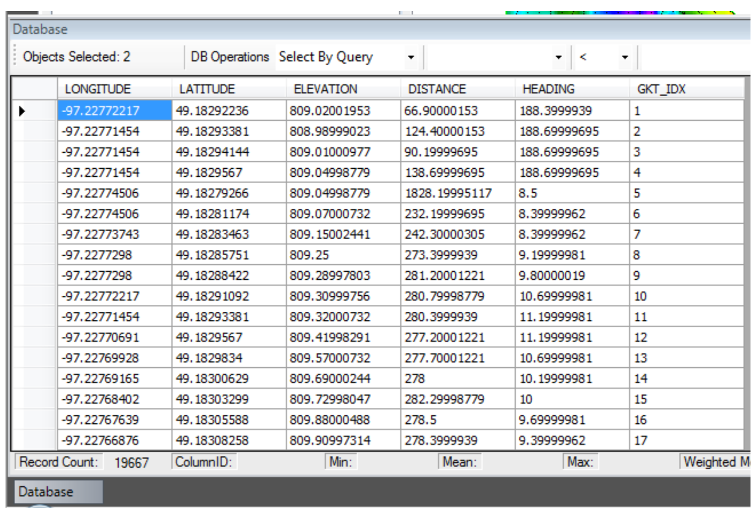


To correct for this problem and to make better topography maps, we need to try to correct the data using some data in the log file.

In order for this to work, there has to be an attribute in the database for the direction of travel or 'Heading'.

Below right is a Deere GS2 collected database, imported using the 'Import Topo' menu in Ag Data Mapping Solution. It is imperative that there be a heading column to make this work.

In order to fix this, we need to figure out how far the offset is from the GPS to the planter. If you are the grower, you probably know this number, if not, we will have to figure it out by zooming in on a zippered area and measure the peak to trough of the wave made by the zipper.



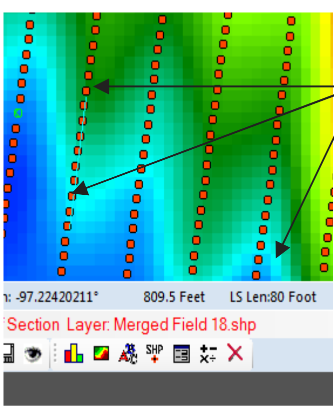
Database

Objects Selected: 2 | DB Operations | Select By Query | <

LONGITUDE	LATITUDE	ELEVATION	DISTANCE	HEADING	GKT_IDX
-97.22772217	49.18292236	809.02001953	66.90000153	188.3999939	1
-97.22771454	49.18293381	808.98999023	124.40000153	188.69999695	2
-97.22771454	49.18294144	809.01000977	90.19999695	188.69999695	3
-97.22771454	49.1829567	809.04998779	138.69999695	188.69999695	4
-97.22774506	49.18279266	809.04998779	1828.19995117	8.5	5
-97.22774506	49.18281174	809.07000732	232.19999695	8.39999962	6
-97.22773743	49.18283463	809.15002441	242.30000305	8.39999962	7
-97.2277298	49.18285751	809.25	273.3999939	9.19999981	8
-97.2277298	49.18288422	809.28997803	281.20001221	9.80000019	9
-97.22772217	49.18291092	809.30999756	280.79998779	10.69999981	10
-97.22771454	49.18293381	809.32000732	280.3999939	11.19999981	11
-97.22770691	49.1829567	809.41998291	277.20001221	11.19999981	12
-97.22769928	49.1829834	809.57000732	277.70001221	10.69999981	13
-97.22769165	49.18300629	809.69000244	278	10.19999981	14
-97.22768402	49.18303299	809.72998047	282.29998779	10	15
-97.22767639	49.18305588	809.88000488	278.5	9.69999981	16
-97.22766876	49.18308258	809.90997314	278.3999939	9.39999962	17

Record Count: 19667 | ColumnID: | Min: | Mean: | Max: | Weighted M

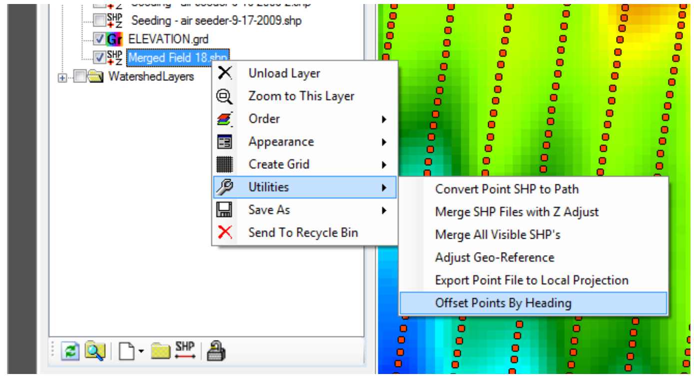
Database



Peak
Trough
And distance from peak to trough of 80 ft.

In this case, that peak to trough measurement is about 80 feet. So an offset of 40 feet would be about right.

Applying The Offset

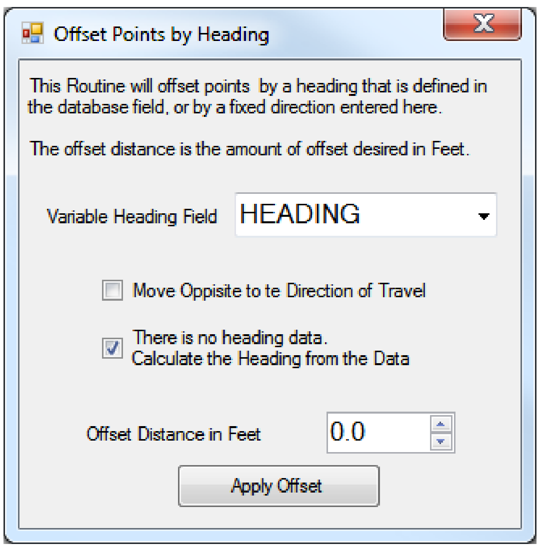


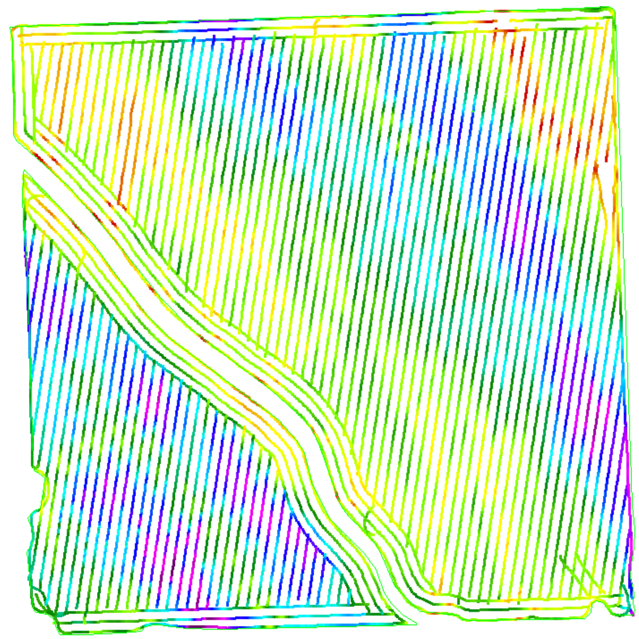
The tool to adjust for this is called 'Offset Points by Heading', and it is on the 'Utility' menu on the right click of a shapefile in the data tree.

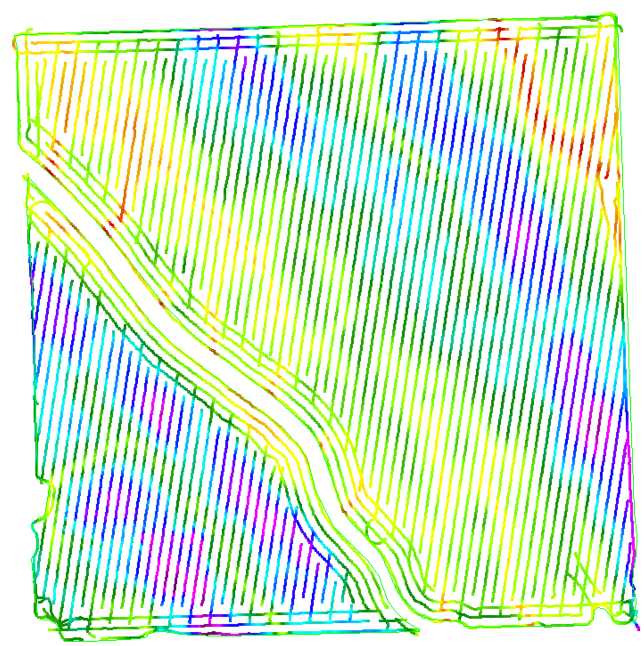
After clicking on 'Offset Points by Heading' the dialog below appears.

In the Variable Heading Field box, select **'Heading'**. Change the offset distance to feet. Since the direction we want to offset the distance is in the direction of travel, leave the box labeled 'Invert the Heading Value' unchecked.

Then click **'Apply Offset'.**







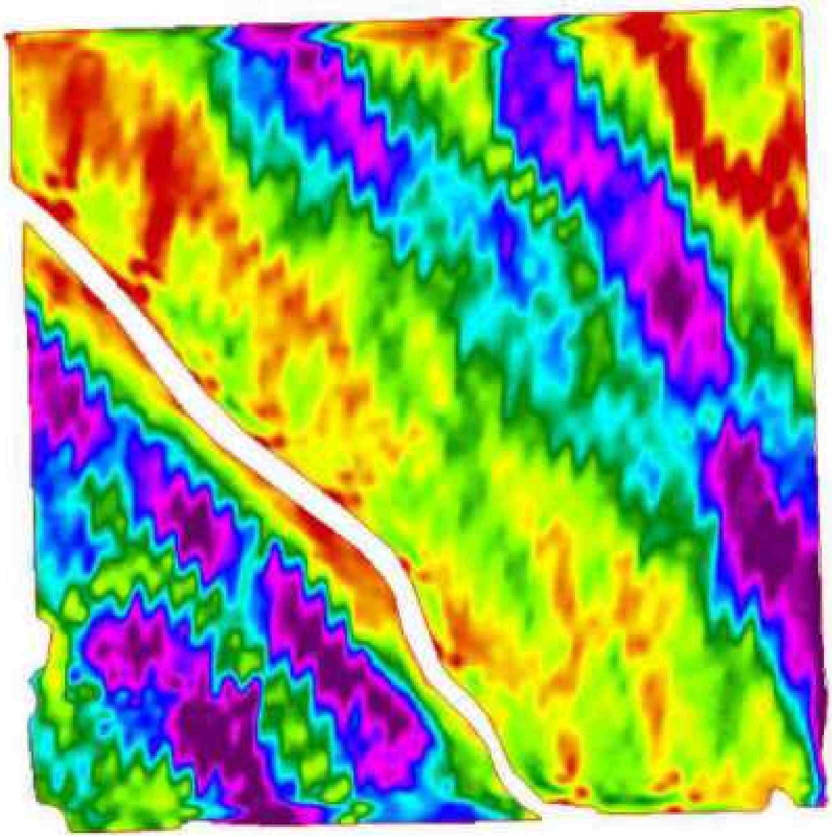
View the results and see if the offset looks right. If not, unload the shape points file, do not save the changes. Reload it and try again with a slightly different number.

When you have the result you want, save the SHP points file to a new layer, and grid it.

You can already see in the point map to the right that it is a much better map.

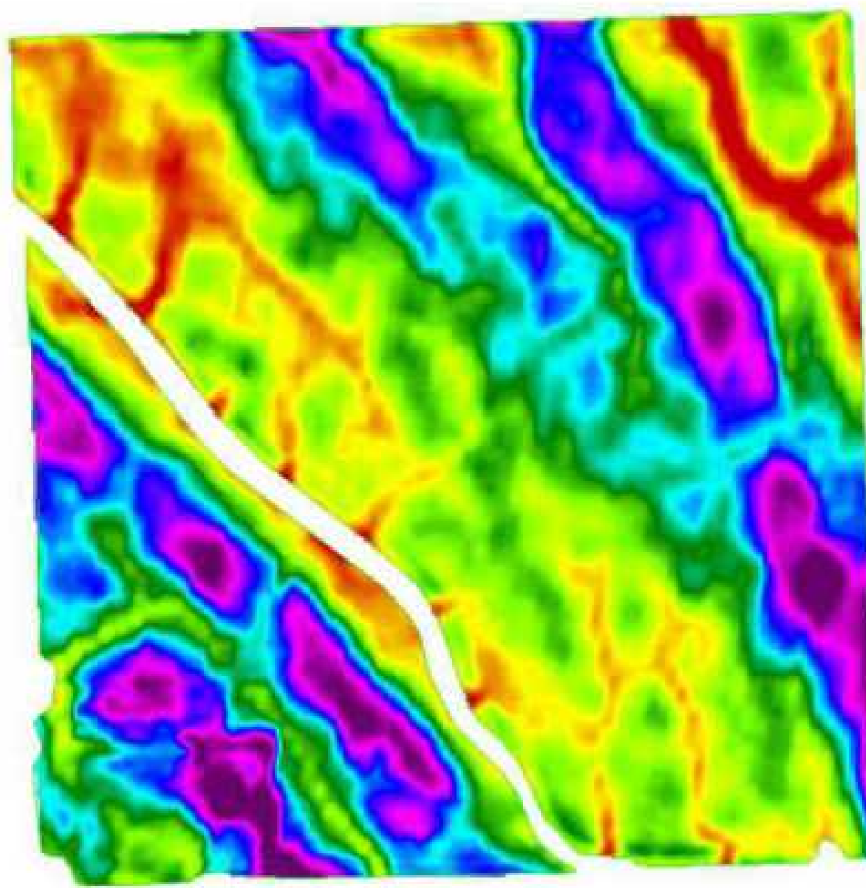
Check out the next page for before and after maps.

Before and After Offset Heading Correction



Before Offset Points By Heading

After Offset Points By Heading



Surface Re-projection

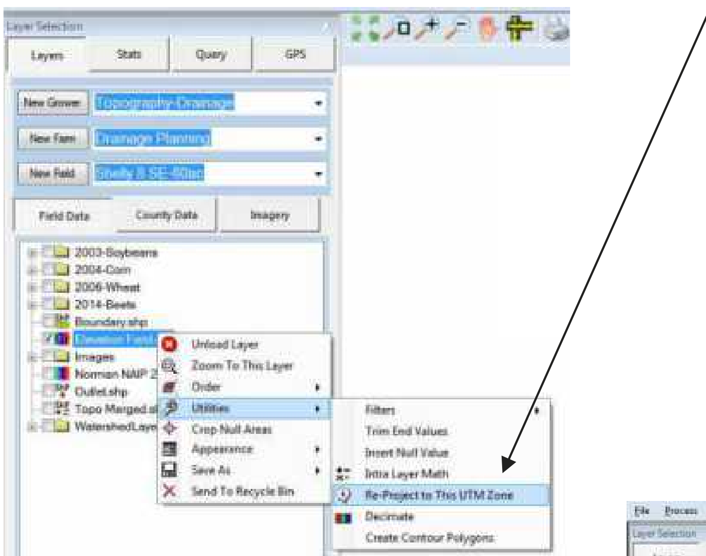
Re-Project the Raster

The data is projected in UTM Zone 15, lines up with boundaries and has the correct coordinates in UTM 15. If you are displaying the rest of the data for this farm in Zone 14, you will need to re-project this data to display it with NAIP data, or other raster data.

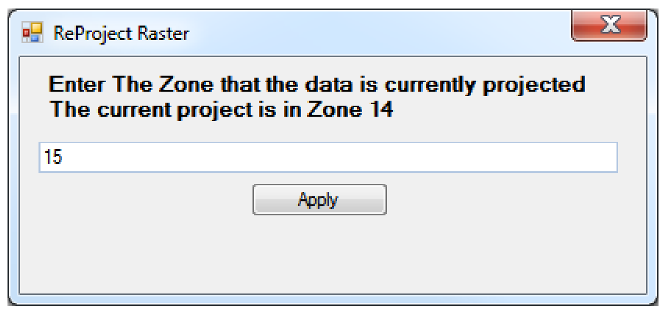
Close "Map Window" and set yourself to the correct UTM. In this example that is Zone 14.

Turn on the Raster to Re-project, and right click

Utilities —> Re-Project to This UTM Zone.

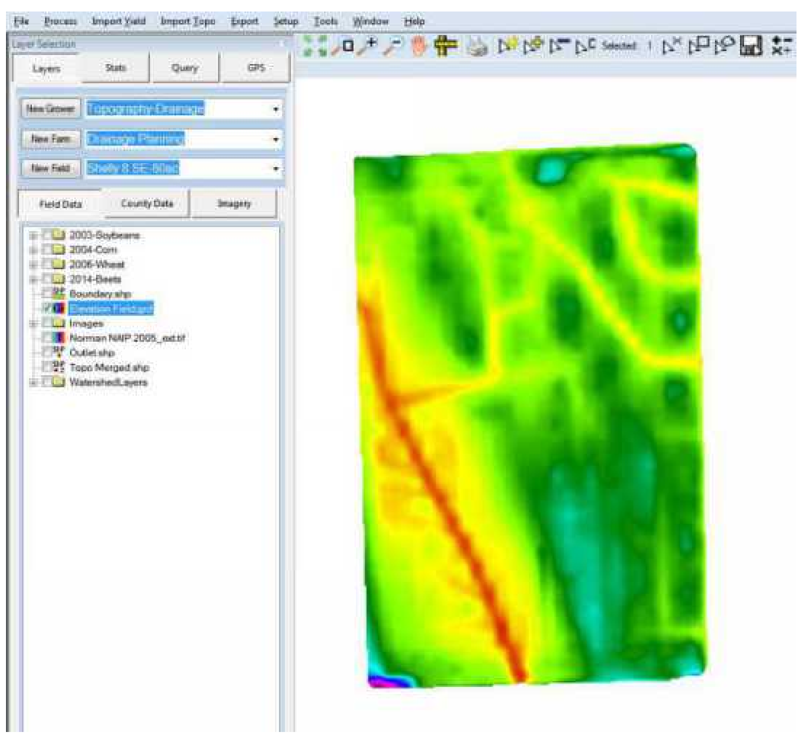


The dialog box below will appear. The data is currently in Zone 15, so enter 15 in the box and click 'Apply'.



The resulting image will now be rotated and scaled to fit in Zone 14.

Then make sure the re-project surface is the active layer, and "Save" the layer.



LiDAR-RTK Merge—Collecting RTK Data to use with LiDAR

We are going to use an example where LiDAR topography is 5 years old and the field has had some surface drainage done on it. This brings up a very important questions. Does that make it any LESS ACCURATE? In this case YES. There are surface drains that have been cleaned. Other examples where this would work well—CRP—Lidar collected in a wet cycle with standing water and many others.

The end use for this data is "SURFACE DRAINAGE". Because it is only being used for surface drainage, only the "Field Ditches" and "Road Intersection" were collected using RTK. If this data would have been for tile, we may have wanted to drive the "Ridges or High spots".

Good RTK collection for this process would include (highs, lows, outlets & road centers).

- driving field ditch bottoms
- road ditch bottoms
- low areas
- outlet & inlet areas
- ridges
- most importantly county road centers north and south
  The road centers will be used for adjusting "X,Y,Z" on the data set
- if the RTK is going to be used for the "Control Point" collect it.

At the point that you are collecting data in field. We suggest that you use your NAIP and LiDAR data for collecting the in field data with ADMS. It will save time and assure you get all the data collected without having to a make multiple collections. Also, you will see these "LARGE" deviations in data collection geo-reference (shown below).

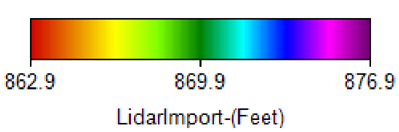
Note: This method works well in scenario's where you are updating small areas or specific passes within the field. This method does not work as well with "Whole" field RTK data collections.

Red Points = LiDAR Control Points (not RTK)
- This Red Point is at the "Road Intersection"
- Points set by hand off the LiDAR map

Black Points = RTK collected using "Mobile Base"
- Note the "Geo-Reference"
- CROSS (+) should be at "Road Intersection"

Collected by driving the center or the road east—west & north—south

Colored map = LiDAR Topography Map



LiDAR-RTK Merge—Adjusting Geo-Reference—Moving RTK

Need to decide which data set is the "control" for setting your "Control Point".

**** In this case we are using the "LiDAR" as the "MASTER"**

**** Moving the RTK DATA**

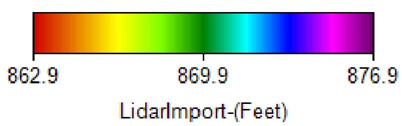
Turn on data in this order

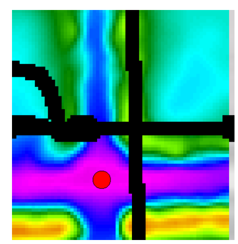
1. Black Points = Ditch Bottom.shp "RTK Mobile Base"
   - Note the "Geo-Reference"
   - CROSS (+) should be at "Road Intersection"

   Collected by driving the center or the road east—west & north—south

2. Red Points = LiDAR Control Points (not RTK)
   - This Red Point is at the "Road Intersection"
   - Points set by hand off the LiDAR map

3. Colored map = LiDAR Topography Map

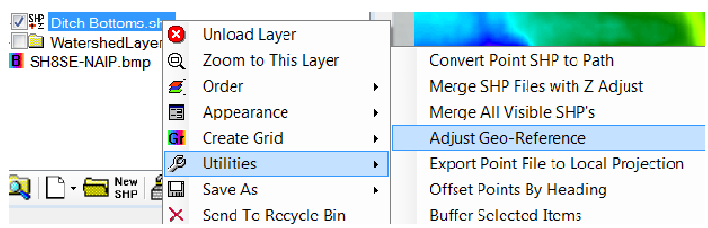




4. Zoom into the Road intersection area (Area of geo-referencing)

5. Use the "Measure"tool to get some close estimates for how much to move the .shp (est. 50' south and 30' west) 

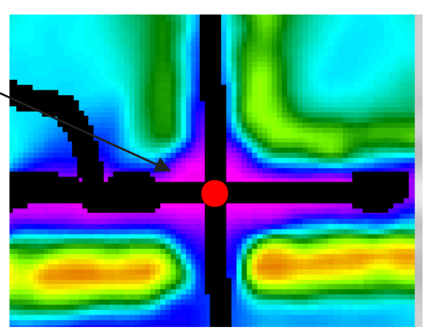
6. Right Click—RTK Points.shp (Ditch Bottoms.shp)
   - choose—Utilities
     - Adjust Geo-Reference



7. Use the "Arrows" or type in the values to move the data. Click "Apply"

8. Repeat step 7 till the data lines up perfectly. Then pan around the field to confirm.

   Example Adjustment:
   Ended up 33' West
   51' South



9. Suggest clicking "Save As" "Ditch Bottom-Adj.shp" or something to identify what was done.

Or

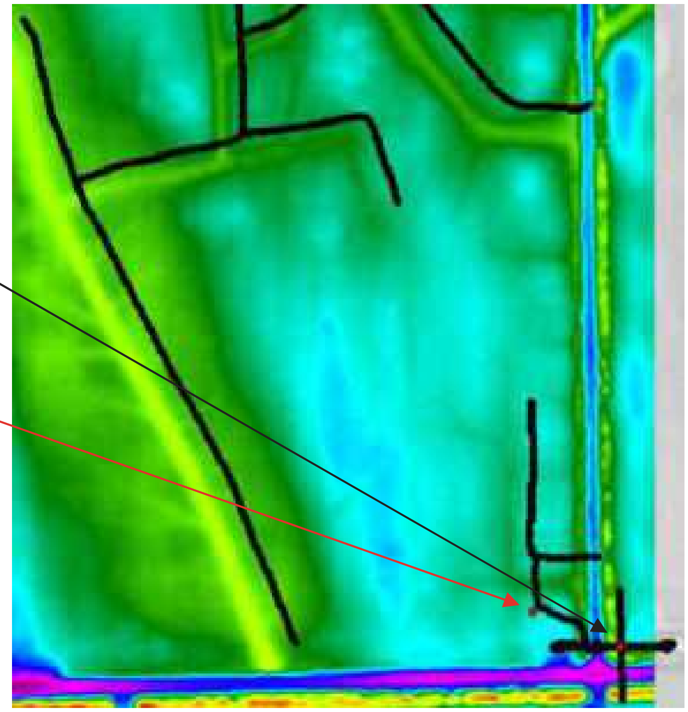
Just "Save"

LiDAR-RTK Merge—Adjusting Geo-Reference—Moving LiDAR

Need to decide which data set is the "control" for setting your "Control Point".

**** In this case we are using the "RTK" as the "MASTER"**

**** Moving the LiDAR DATA**



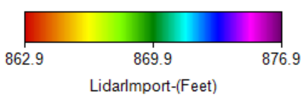
Turn on data in this order

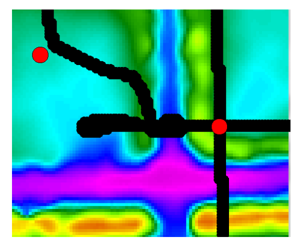
1. Black Points = Ditch Bottom.shp "RTK Mobile Base"
   - Note the "Geo-Reference"
   - CROSS (+) is at "Road Intersection"

   Collected by driving the center or the road east—west & north—south

2. Red Points = RTK Control Points (not LiDAR)
   - This Red Point is at the "Road Intersection"
   - Second point set at a "Physical" mark, a "stake" driven in the ground in this example.

3. Colored map = LiDAR Topography Map
   - Road Intersection needs to be aligned with RTK CROSS.





4. Zoom into the Road intersection area (Area of geo-referencing)

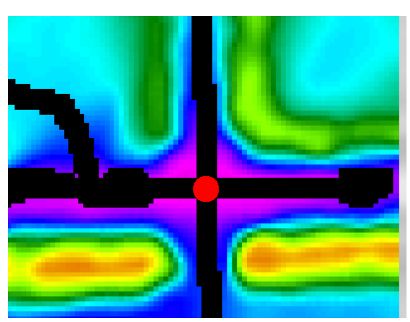
5. Use the "Measure" tool to get some close estimates for how much to move the .shp (est. 50' north and 30' east)

   The movement will be made in "METERS" so divide the values by 3.2808
   (est. 15.24 meters north and 9.14 meters east)

6. Make "LidarImport.grd" your active layer

7. Click the "Surface Properties" button on the bottom toolbar.

8. Write down the Northing—Easting values so you know your starting point



9. Use the Arrows to "Adjust Geo-Reference" till the data lines up perfectly. Then pan around the field to confirm alignment.
   - *Confirm Units = Feet*
   - *Confirm Decimal Precision = 1*

10. Click "Save"

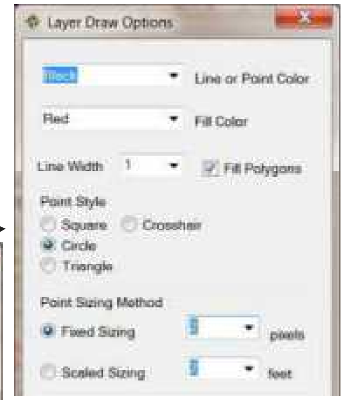
LiDAR-RTK Merge—Adjusting Elevation & Merging Rasters

The LiDAR and RTK are "aligned" on a X-Y axis. We need to adjust the Z axis. You must have data in areas were the elevation that has NOT changed over time. In this example we are using the road and the field entrance.

1. Turn on "LidarImport.grd" and "Ditch Bottom.shp"

2. Make Ditch Bottom.shp the Active Layer

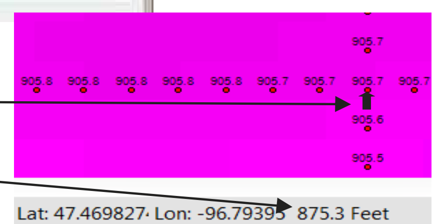
3. Click on the "Change Draw Style"
   - Change settings like this
   - Click "Apply"



4. Click on the "Change Label Settings"
   - Change settings like this
   - Click "Apply"

5. Zoom to the area of the data to take elevation readings

6. Scroll your mouse over the SHP point
   Take readings RTK 905.7'
   - LiDAR 875.3'
   Difference 30.4'



7. Repeat this function several times (5 to 10 suggested).
   Average all the "Difference" values. This will be the amount you adjust the "Elevation Data"
   For this example the average was 30.43'

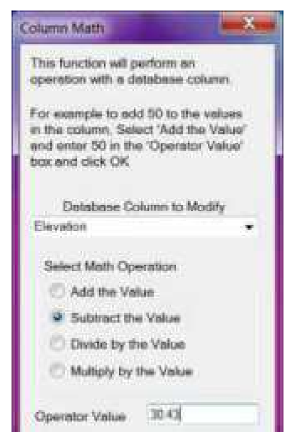
To Adjust the SHP RTK Data

1. Make Ditch Bottom.shp the Active Layer

2. Click the "Preform Math operation on a Column"
   on the bottom toolbar.

3. Choose column to amend & "Add" or "Subtract" & enter "Value"
   This example "Elevation" & Subtract & 30.43

4. Click "Apply" and "Save"



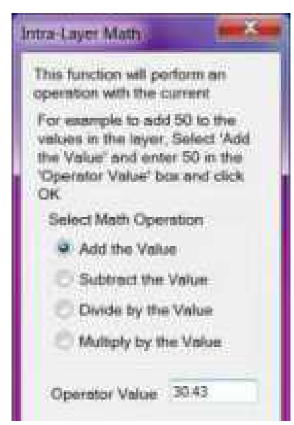
To Adjust the GRD LiDAR Data

1. Make LidarImport.grd the Active Layer

2. Click the "Intra-Layer Math" on the bottom toolbar.

3. Choose column to amend & "Add" or "Subtract" & enter "Value"
   This example "Elevation" & Subtract & 30.43

4. Click "OK" and "Save"



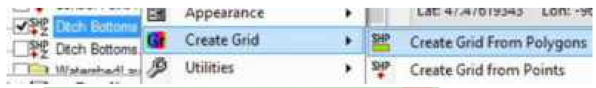
LiDAR-RTK Merge—Adjusting Elevation & Merging Rasters

Both the LiDAR & RTK are adjusted to match on the X / Y / Z axis. The final step is going to be “Merging” the data sets. There are two methods of merging that could be used in ADMS, merge as “Rasters” or merge as “Vectors”. This example will show you the “Raster” method.

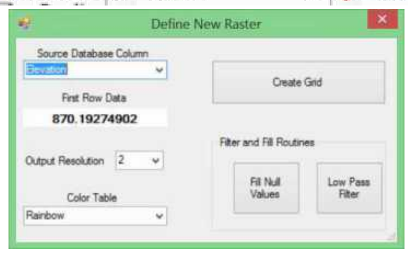
Start by “Clearing” the map.

1. Turn on Ditch Bottom.shp & make it the Active Layer
2. Right Click on the Ditch Bottom.shp

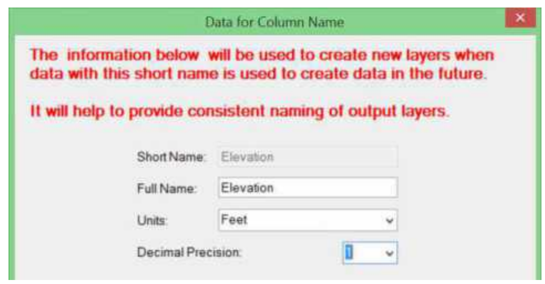
   Note: “Point Size” will effect the next step.
   Generally use 10’ - “World Size”



3. Select “Create Grid” & “From Polygons”
   - Select Column—Ex. = ”Elevation”
   - Output Resolution = 2
   - Color Table = Rainbow
   - Click “Create Grid”



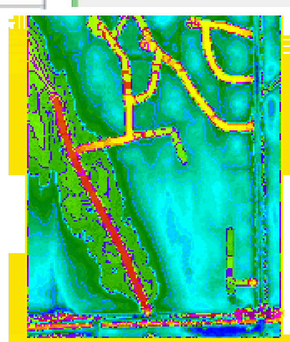
You may be prompted “Data for Column Name” Window. Fill in like below & click “OK”
NOTE: DO NOT use “field names” - use “Event names”

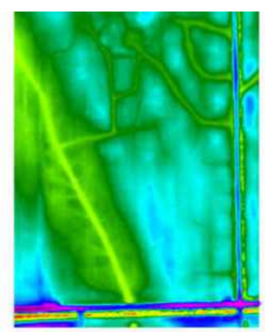


- “Fill Null Values” - click 1 time (data in pass should touch)
- “Low Pass Filter” - click 1 time

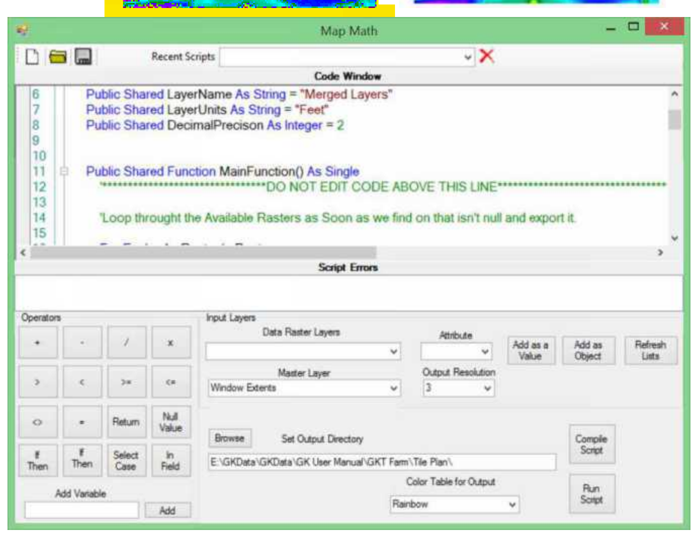
4. Turn off Ditch Bottom.shp
6. Turn on the LidarImport.grd & Elevation.grd
   - May want to toggle Front to Back to compare.

7. Layer sequence is very IMPORTANT.
   -The first surface turned on (Back/Bottom) will be on top after the “MERGE”
   -Only turn on surfaces to “Merge” (no extras)

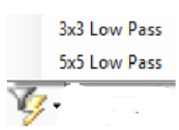




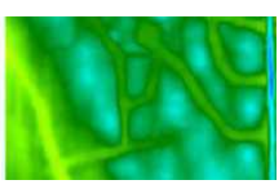
8. Click “Multi-Layer Map Math”  button top toolbar
9. Go to the “Open Existing Script” button 
10. Choose “Merge All Visible—Feet”
11. “Compile” & “Run Script”



12. Close “Map Math” window
13. Typically do a 3x3 Smooth Filter



14. “Save” the “Merged Layers.grd”
   - *Suggest re-naming “Merged RTK-Lidar.grd”*
15. Ready for Watershed or Drainage Planning.

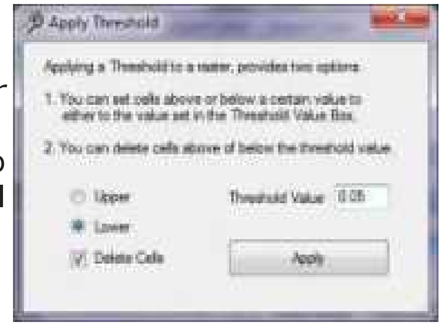


My Notes

Quick Notes For Drainage Planning—Map Window

Adjust Depressions—Main Depressions

1. **"Map Window"**
2. Open **"Depressions"** set as the **active layer** , select **"Trim End Values".**
3. **"Apply Threshold",** select "Lower" & "Delete Cells", we suggest starting "Threshold Value" at 0.05'
4. Click **"Apply".**
5. Look at new "Depressions", inspect the map, if satisfied go to 7
6. *If you want to trim more repeat 3 & 4. If you went too far, "Clear Map" and DO NOT SAVE CHAGES to Depressions.grd.*
7. Click on the **"Save AS"** icon on the bottom tool bar. Rename to "**Depressions-Main"** & click Save (if you do not do this, you will lose the original Depressions layer).
8. Under the "**Layer Info"** tab, click on **"Clear Map"**.



Creating Dump Areas

1. Turn on all the maps required to help define the dump areas.
2. Click **"New"** and select **"Dump Areas".**
3. Click on the newly created **"Dump Areas.SHP"** Dump Areas.SHP file to turn it on and make it the **active layer**.
4. Select the **"Draw New Object"** from the bottom toolbar - Left click around your Dump Area - Right Click to close Polygon.
5. Repeat step 4 to create all your Dump Areas for this field.
6. When finished, **"Save"** from the bottom toolbar – Dump Areas.shp (Overwrite – "Yes").

Saving Images for Ditching

1. Turn on your desired layers to view while ditching (combination listed below)
   A. County NAIP, Flow Accumulations, Main Ditches, Hills, Dump Areas
   B. Watersheds, Flow Accumulations, Main Ditches, Depressions, Dump Areas
   C. Topo Features, Flow Accumulations, Main Ditches,
   D. May want to use the **"Transparency"** settings.
2. Go to **"File"** – **"Print"** – **"Print Map to Bit-map"** *(this function only works in the "Map Window")*
3. Location, save this file into the same field folder you were working in.
4. Name the file something simple that captures the field location ex – sec32sw
5. Save this file as a BMP for most applications
6. Click **"Save"**

Moving BMP Files to Other Devices

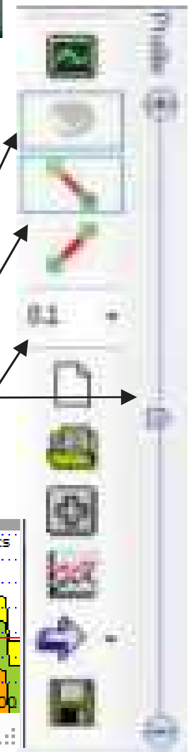
1. In most cases, you will be moving files with removable storage drives.
2. In ADMS, click **"Explore this Folder"** icon.
3. You are now looking inside the **"Field Folder"** in Windows File Explorer.
4. Using our example, highlight both **sec32sw.bmp** and **sec32sw.bpw.**
5. **"Copy"** these two items (select **"Edit"** – **"Copy"** from the toolbar).
6. **"Paste"** them onto the removable storage and take them to your other devices (AGPS / APEX / SMS)
7. Now ready to take the removable storage to other PC or device.

Quick Notes For Drainage Planning—Drainage Window

Viewing Data – Drainage Window

1. When ADMS starts, Click on "Drainage Window"
2. Check your "LidarImport.grd" (you can un-check this layer now)
3. Turn on your desired layers to do ditch planning
   a. County NAIP, Flow Accumulations, LidarTopo
   b. Watersheds, Flow Accumulations, Depressions

Profile Lines (Profile Bar – Right Side of Map Window)

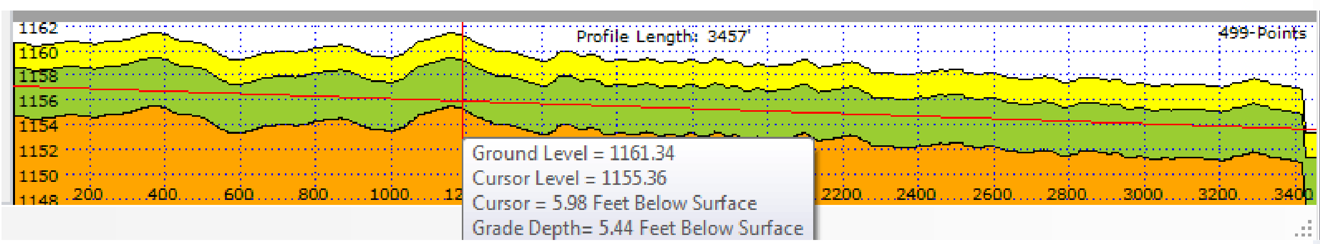


1. Click on "Profile" on the top toolbar
2. The first time, it will ask you what "Raster" to calculate the Profile off of – "LidarImport"
3. Surface Drainage – Start at the lowest point of the "Depression"
4. Left click to lay out your drainage profile line, notice the numbers at the bottom of the screen.

Elev. @ cursor	Line Length	Rise / Fall	Cut / Fill @ profile grade	Actual Grade
860.7 Feet	Length: 1,073 Foot	Drop: 0.48 Foot Drop	Cut0.05 Foot	Grade:0.045 %

5. Check "Show Grade Line" eye
6. Check either "Left to Right" or "Right to Left"
7. Use the "Profile" slider bar to adjust the location of the **Profile Line**
8. Change your Grade % to change the grade of the **Profile Line**

Moving up and down on the vertical line will give your location and cut information.



Note on the Profile:
Top Line = Soil Surface (Above the Yellow)
Middle Line = 2 Foot Minimum for Drain Tile (Between Yellow & Green)
Bottom Line = 6 Foot Maximum for Drain Tile (Between Green & Orange)

Saving Profile Lines (Profile Bar – Right Side of Map Window)

1. Click on the "Create New Plan" button or "Open an Existing Plan". (Once per field session).

2. Create a profile you want to save, click "Add Current Profile to Plan".
   a. Repeat 1 & 2 to layout your Drainage Plan

3. Click on the "Save Profile Layers to File" button to save the file
4. Repeat your Profile Lines section and Save Profile Lines until you have all the Ditches created for the field. (make sure you)

5. Click on the and select "Export AGPS Profiles" or "2D Shape"
6. Save the file back into the field folder and use a simple field name so you can identify this later. (ex. – "sec32sw.AGP_PRF" for AGPS or "MainsTemp.shp" for use in ADMS.

Repeat the steps above for doing your Drainage Planning.

Creating Tile Plan

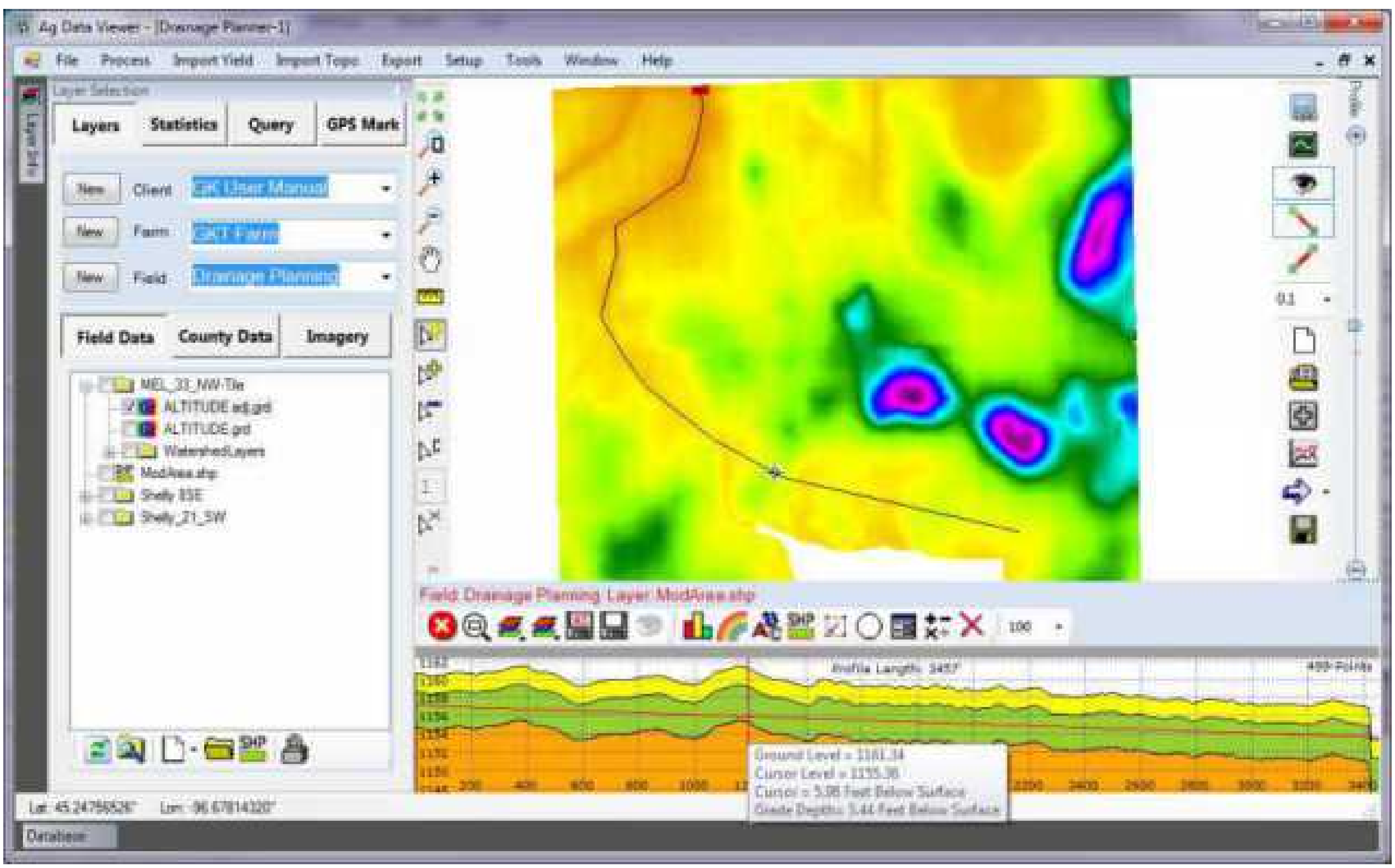
Tile Design

The idea of tile design can be as simple, or complex, as you want it to be. Tile plans have many factors that can influence the decision-making process. At this point in time, our software can calculate the number of acres within a watershed. We do **not** calculate drainage co-efficient and pipe size. Users need to use a pipe size calculator for this determination. Always remember the most important part of the whole project is your outlet elevation reading.

Components that should be completed **before** starting a tile design.

1. Collection of RTK, or LiDAR, topography data.
2. Outlet elevations have been determined (data collected).
3. Data has been processed into ADMS through Watershed Modeling & Contours (1 foot).
4. Tile "Templates" have been built in ADMS.
5. Wetland and utility locations have been defined, (final verification required).
6. Permission: Project permitting and the ability to do the project has been verified.

The following "Tile Planning" example will require the data sets shown below.

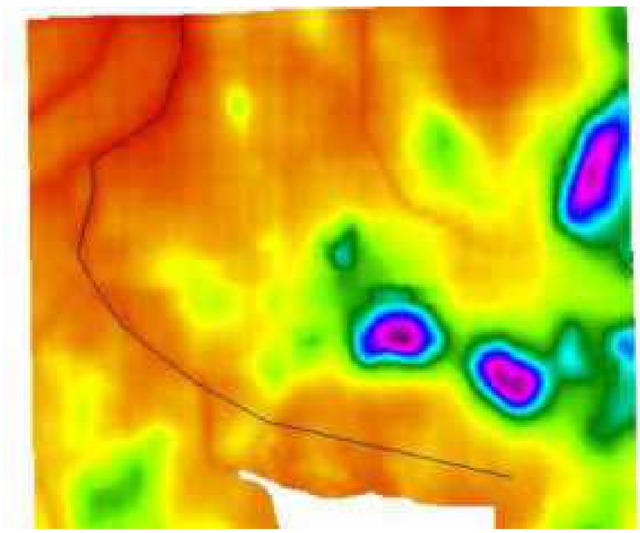


Creating Tile Plan

Directions for the Project

Land Owner wants to

- Pattern Tile : Red & Orange areas of the field
- Spacing : 100’
- Drainage Coefficient : 1/4”
- Soil Types : Sandy Clay Loam
- Wetland Setbacks : Yes
- Buffer : 200’ set back on the 15ac wetland on south end
- Minimum Grade : 0.1% (1’ drop per 1,000’)
- Minimum Install Depth : 2’.
- Optimum Install Depth : 4’.
- Maximum Install Depth : 6’.



Steps:

1. Create outlet points.grd (if required).

2. Merge with Topography.grd (if required).

3. Create set back for wetland & utilities.

4. Determine the locations of the “Mains”.

5. Choose “Pattern” design & guide lines.

6. Use Tile Calculator - Determine “Tile Size”.

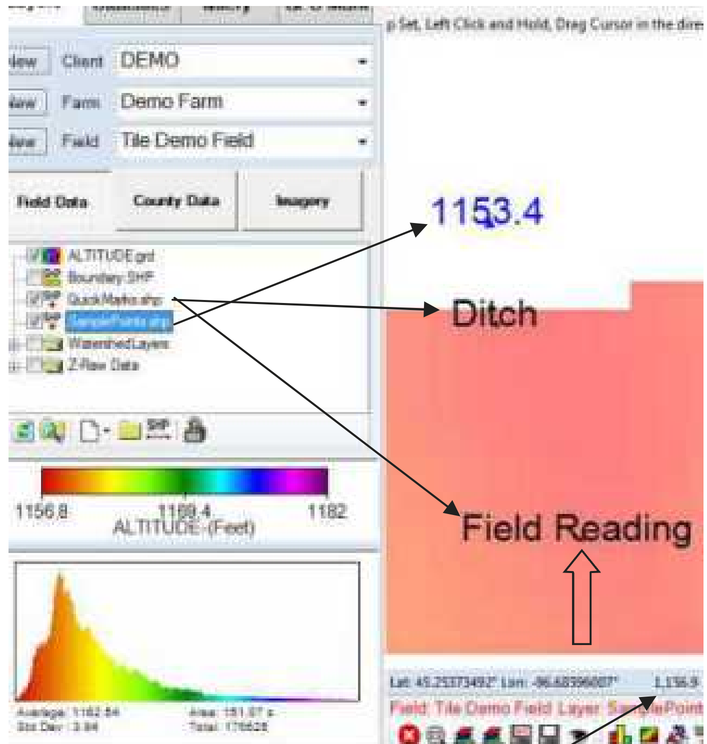
7. Draw in “Sized Tile Plan”.

Here is the ROUGH plan sketched out on a FSA map.

Creating Tile Plan—Outlet Points

Data Collection - GPS Example

We suggest using a pickup or an ATV for collecting field data. However, many times in topography data collection, you cannot get to a location to collect a point with a tractor, pickup or an ATV. Have a grade rod with a mount for the GPS at the exact same height as the pickup mount. GPS must have at least 25' of cable to get to ditch bottoms or culverts. Use Quick Marks in ADMS since other marking devices may, or may not, log elevation values.



Data Collection - Laser Example

Get a survey rod and setup Laser at a 0 grade.

Mark a GPS point in the field

Take a Grade Rod reading (on paper)

Reading 4.3'

Mark a GPS point near your Culvert or Ditch bottom reading

Take a Grade Rod reading (on paper)

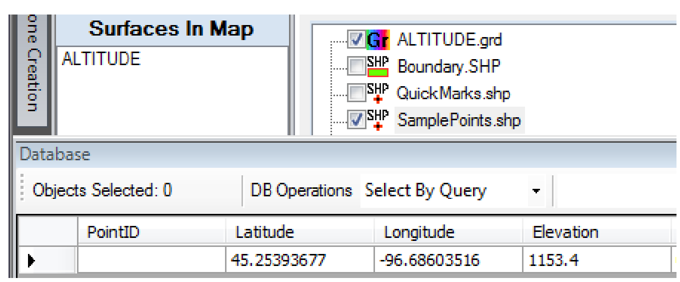
Reading 7.8'

Subtract the two values 7.8 - 4.3 = 3.5 Drop

Create a New SHP file "Create Layer from Template" - "Sample Point"

Check on Sample Point.shp and Click "Draw New Object" "SHP" button

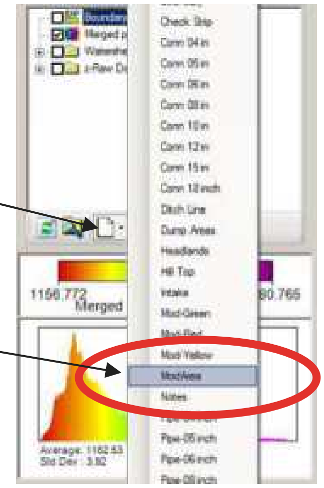
Mark a point in the bottom of the ditch just in from your GPS Mark Point.



Get the Value from the "Field Reading" off the "Cursor" value = 1156.9

Go to the "Database" tab and enter 1153.4 in the Elevation column (1156.9 - 3.5 Drop)

Creating Tile Plan—Modify Topography Maps using ModArea



1. Turn on the topo file that is to be modified, i.e. **"Merged points-Altitude.grd".**

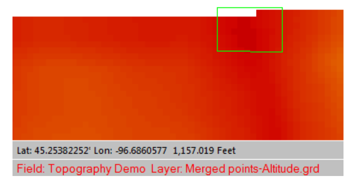
2. Click the "Create New Layer from Template" button.

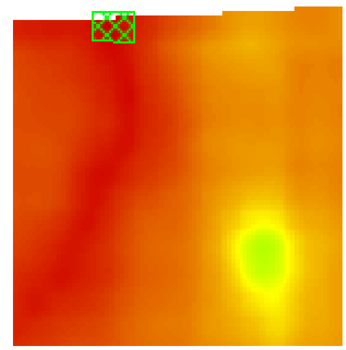
3. Choose the "ModArea" template.

4. Check it in the data tree. (It should now be the **Active Layer**).

5. Zoom in to the area that needs to be modified.

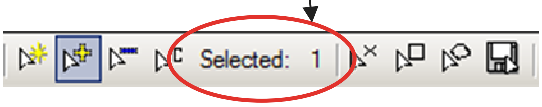
6. Select the "Draw New Object" button.



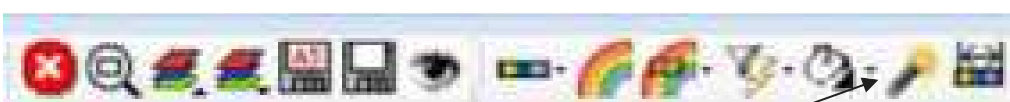


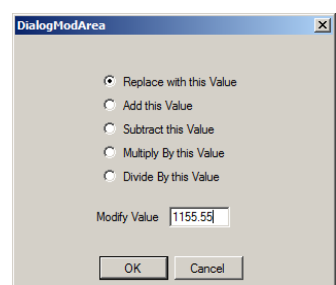
7. Draw a polygon around the outlet area (this will normally be a culvert or ditch bottom with a **KNOWN** elevation).

8. Use the selection tools on the top toolbar to select the ModArea (Again, this is indicated by the green crosshatch making sure only one polygon is selected.)



9. Now, make the **"Merged points-Altitude.grd"** the **Active Layer**.

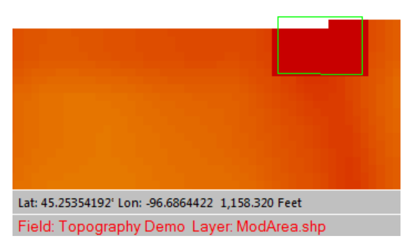




10. Check the "Apply Mod to Selected Polygons" Magic Wand button.

11. In the popup "Modify Pixels Under Drawn Area" box, check the "Replace with this Value" radio button and type in the **KNOWN** elevation.

12. Click OK and save. You have now successfully adjusted your topography map to reflect the correct outlet elevation.



Creating Tile Plan—Merging Topography

Our OUTLET (Sample Point.shp) is not in the correct format (needs to be a .grd surface)

Check on the Sample Point.shp

Right Click Sample Point.shp
Create Grid - From Polygon

Click on "Create Grid"

Click the "Fill Null Values" button 3 times
-Or until you get to the size you want

Turn both "Altitude.grd" and "Sample Points.grd" (must be able to see both maps)

Click on the "Multi-Layer Map Math" on the top toolbar.

Open the "2 Layer Merge" Script

Change Line 8 from "lbs/ac" to "Feet" for topography maps.

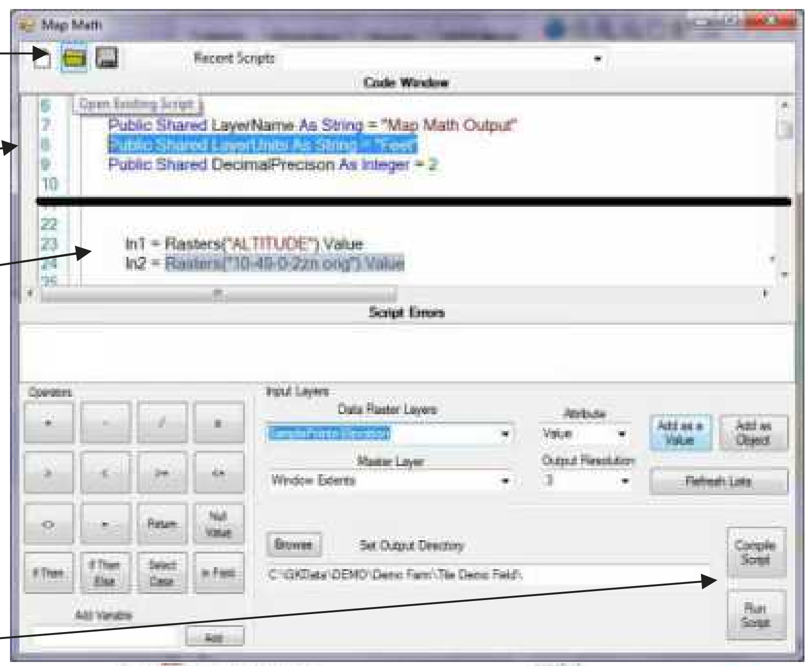
Line 23—Highlight everything behind "In1 ="

Select "Altitude" under "Data Raster Layers" and Click "Add as Value"

Line 24—Repeat previous 2 steps assigning the "Sample Points" layer

Click "Compile Script"

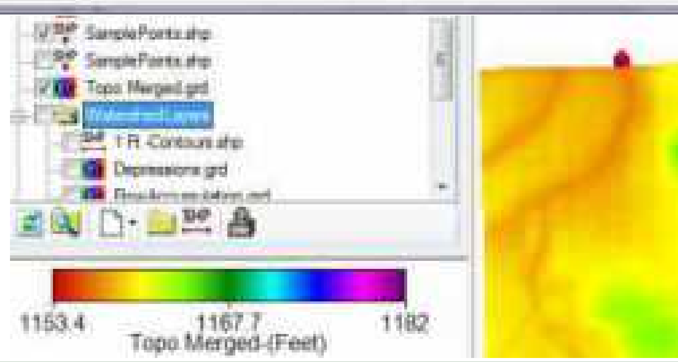
"Run Script"



Click back to "Map Window" & "Layer Info"

Click on "Map Math Output"

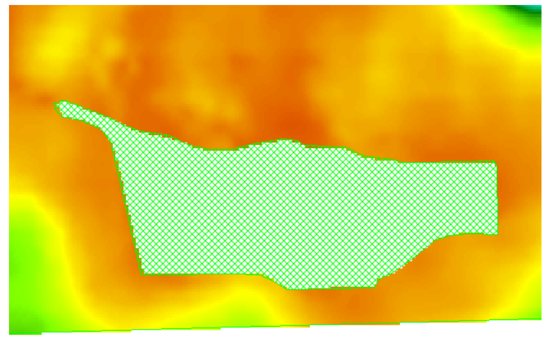
"Save As" - Topo Merged.grd or whatever name fits



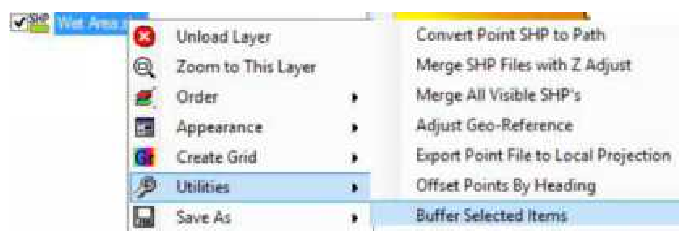
Creating Tile Plan—Setbacks (Buffer Selected Items)

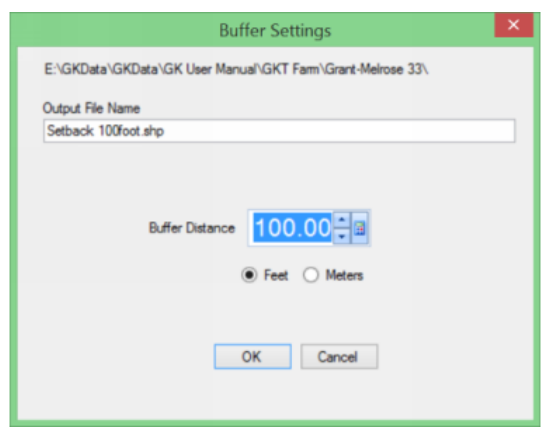
To create wetland or utility setbacks", you must first draw a boundary around the "Wetland"

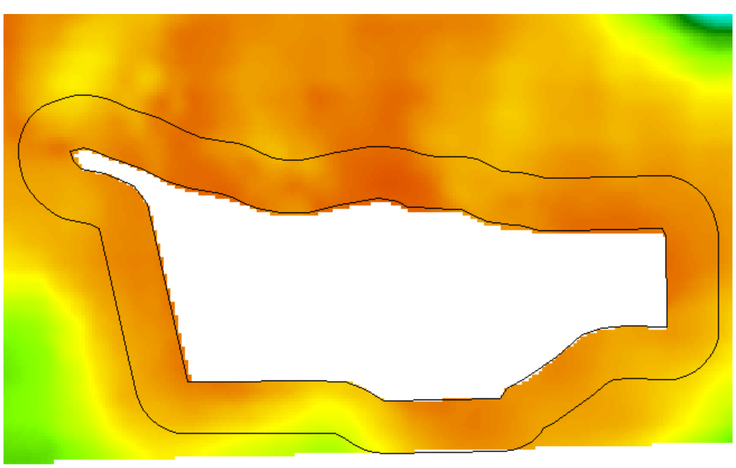
1. Turn on the "Field Data" layers needed to define a wetland or utility.
2. Select "Wet Area" from the "Create Layer from Template" list.
3. Zoom in to the area of interest.
4. Check on Wet Area.shp.
5. Bottom Toolbar, click "Draw New Object" - "SHP" button.
6. Draw a boundary around the Wetland
7. Once Finished "Save"
8. Clear Map



1. Check on Wet Area.shp.
2. Click inside the "Polygon" making it **"1 Selected Object".**
3. Right Click on the "Wet Area.shp" and "Buffer Selected Items"
4. Name the file to be created—example "Setback 100foot.shp"
5. Adjust the "Buffer Distance" ex—100 feet
6. Click "OK"



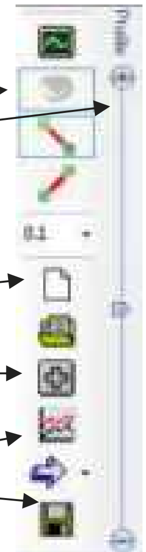


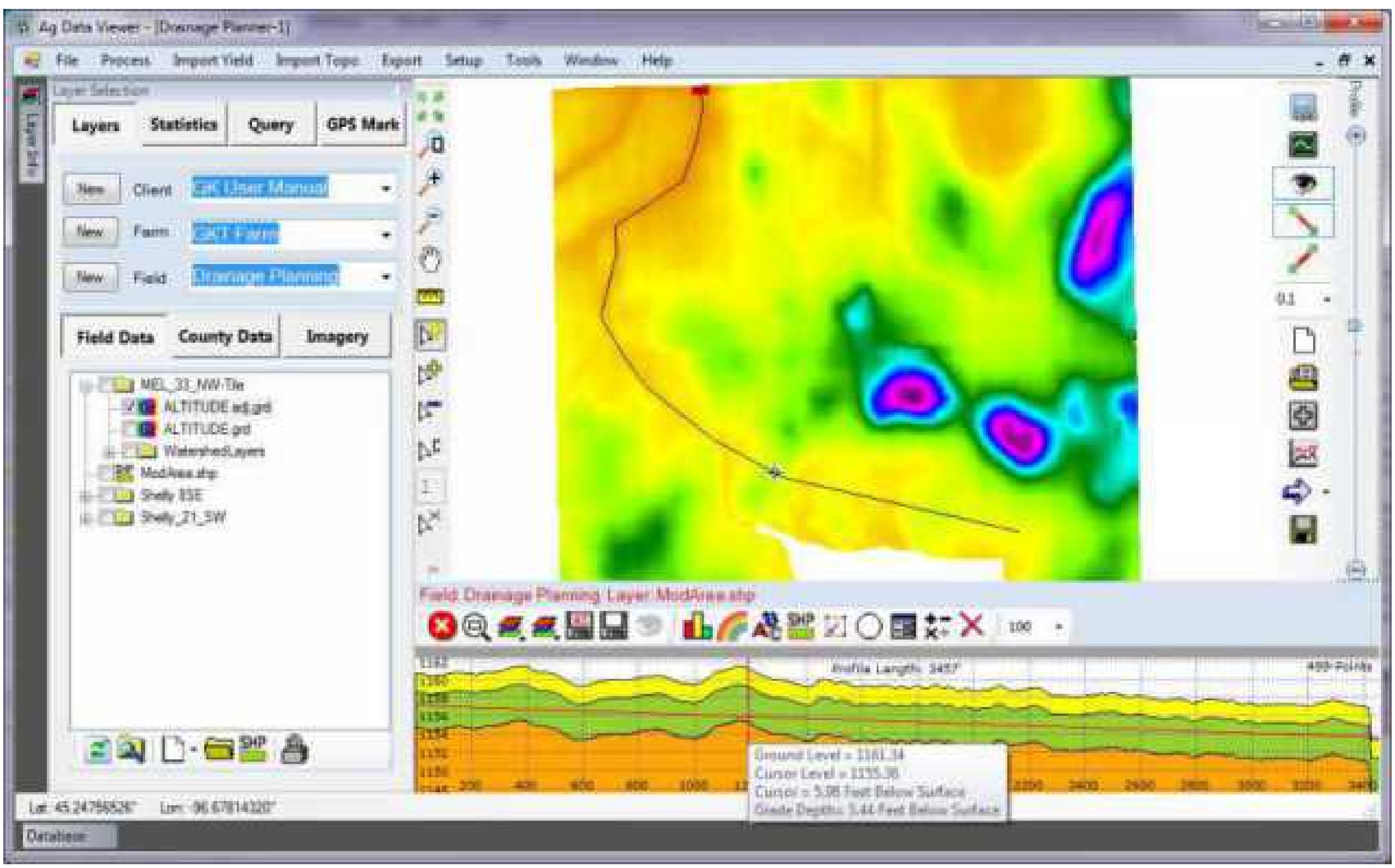


Creating Tile Plan—Main Locations

Choosing Outlets and laying out Mains is the heart of a tile plan. Make sure your outlet has the depth to handle all the holes of the field.

1. Turn on all the layers needed for planning
2. Go to the "Profile" tab and set the "Grade" to the "Minimum Grade".
   *As you are planning from the outlet back into the field, the "Grade Line" should not come higher than your "Minimum Depth".
3. Click on the "Profile" button & click out the Main From Outlet to furthest Lateral
4. Check "Show Grade Line"
5. Slider Bar for Tile Height
   We suggest using the "Grade Line" as the bottom of the tile. Example - 24" tile needs to be in at 4' to get 2' of cover.
6. "Create New Layer" & name it- ex. -"tile plan 1"
7. Click the "Add Current Profile to Layer" Button
8. Repeat 3-7
9. Click "Save Layer" under the profile tab.
10. Once saved, use the "Review Profile" button to recall lines.





Creating Tile Plan—Main Depths

Most important part of any system is the OUTLET

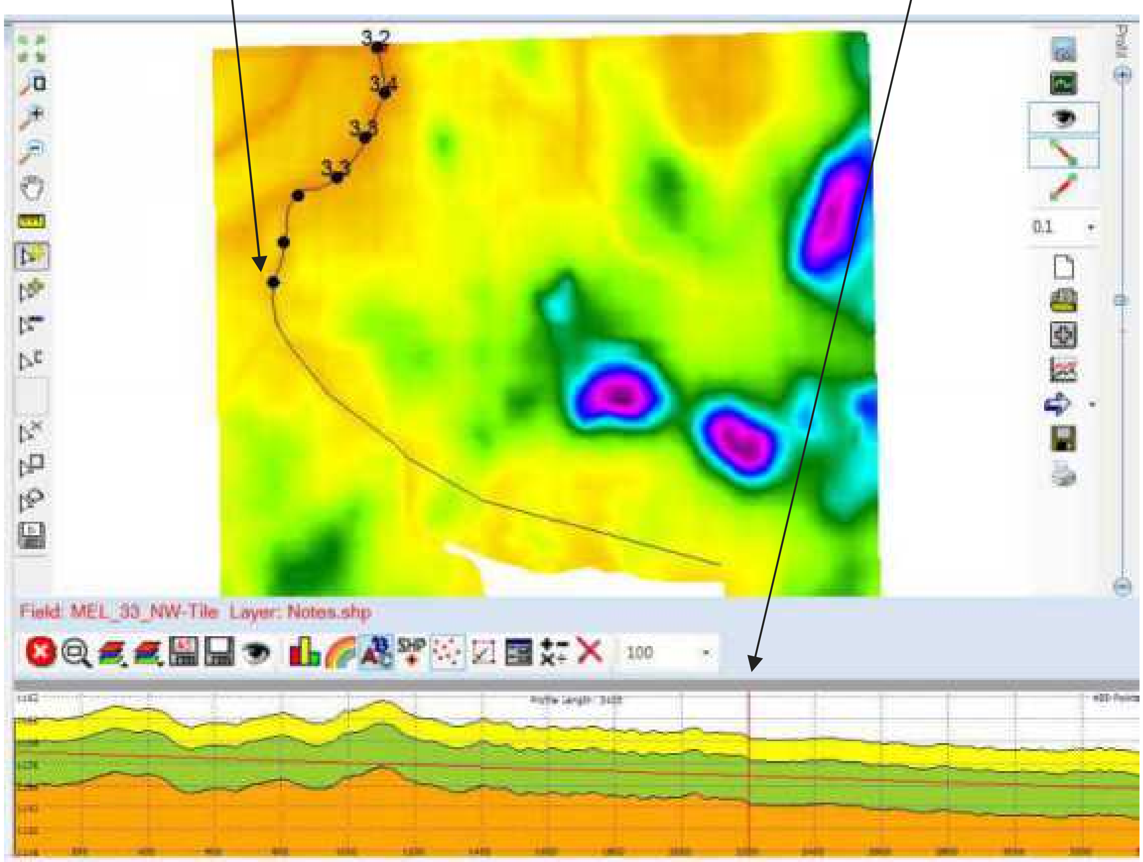
The second most important part is getting "MAIN DEPTHS"

These instructions will show you how to drop Points to mark Pipe Depths that can be turned on and printed out at any time and used as guides for designing laterals.

1. Starting where you have your Outlet and Main Locations set (previous page)
2. Go to the "Create New Layers from Templates" & select "Notes"
3. Check this on and make it the active layer.
4. Select either "Draw New Object" SHP or "Draw Multiple Points Attributed from Surface" on the bottom toolbar.

   Note: SHP will need to be clicked for each point & is a toggle On / Off button
5. Suggest using either a "Equidistance" or "Landmark" method of marking points.

   Example—Starts at "ditch shoulder" the every 200 feet
6. To get the spacing move your cursor along the "Profile" & slide it out the top at the spacing marks.
7. Click on the "White cursor" to mark the points (marked over the top)
8. Once all marked click "Save"



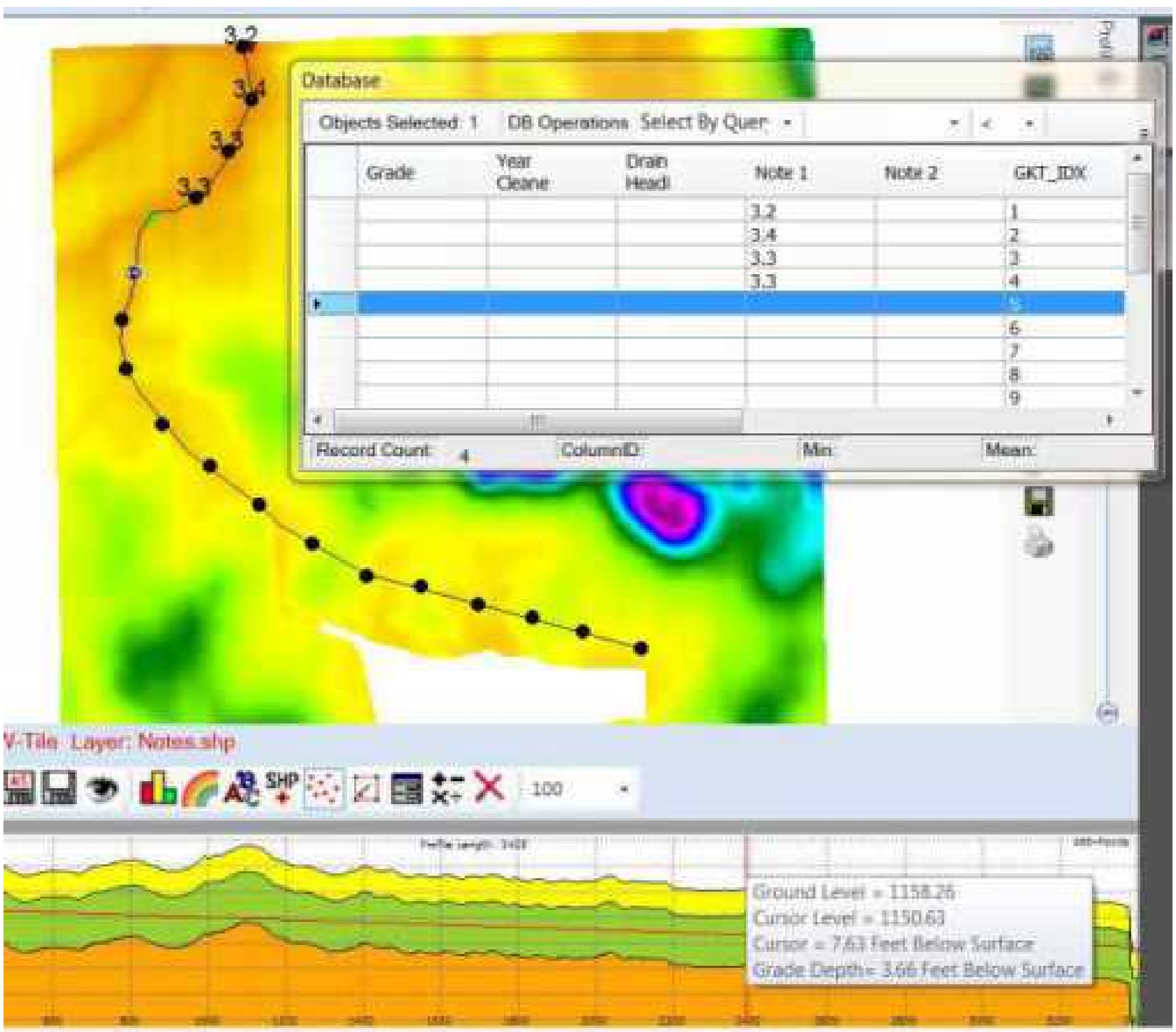
Creating Tile Plan—Main Depths

Once you have all the Points drawn & Saved

Need to add DEPTHS then LABELS

1. Make sure the "Notes.shp" is the active layer.
2. Go to the Bottom Left corner and click on "DATABASE", when it opens click and hold on the header and drag it up over the screen. Size to your preference, will be entering depths in the "Note 1" column.
3. In Database click on the Gray Cell on the Left—this will highlight the point on the Map
4. Move your cursor around in the "Profile" area, match the cursor with highlighted point
5. Key in the "Grade Depth" value
6. Repeat till finished & go to bottom toolbar & "Save"
7. Make sure the "Notes.shp" is the active layer.
8. Click on "Change Label Settings" on the bottom toolbar.
9. You now have "Main Depths"

NOTE: When finished "Re-Dock" the "Database" at bottom.



Creating Tile Plan—Pattern Design & Guide Lines

Pattern Design is a bit of preference and a bit of art. Spacing can change due to soil types, depth and preferences.

1. Zoom into an area you will be Grid or Pattern tiling

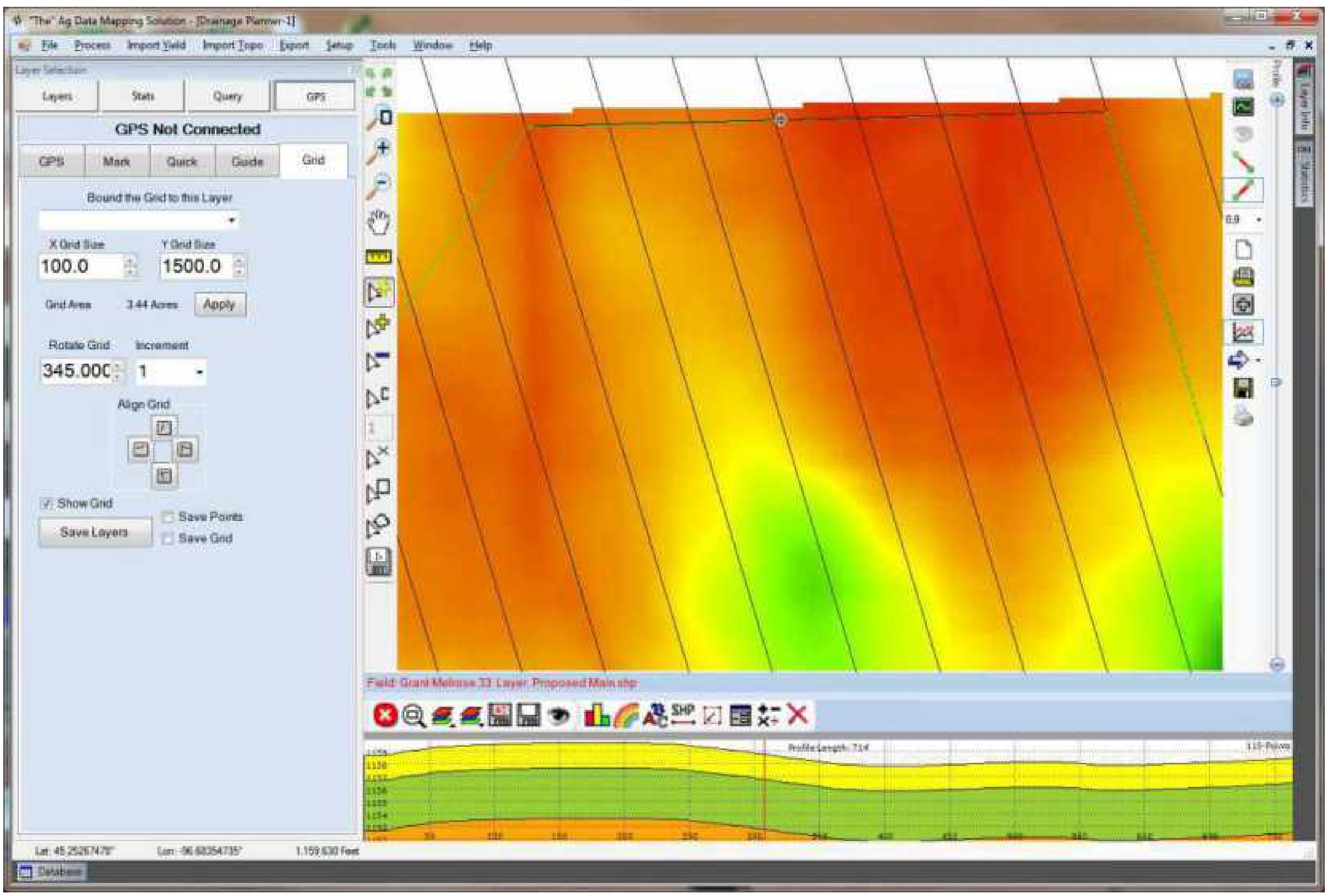
2. Go to the "GPS Tab" and "Grid"

3. Set your X & Y Distances (ex - X= 100 and Y = 1500 or greater)
   In this example, X is the pipe spacing, not always the case

4. Click "Apply" then check the "Show Grid" box

4. Rotate & Align Grids as you see fit and check "Save Grid"
   You may need to have many different angles and spacings

5. Click "Save Layer" to name it to define the object. If you have many areas, plan!!



Creating Tile Plan—Calculating Tile Size

You will need a Drainage Slide Rule for this part. Slope & drainage coefficients (how much water is drained in a 24 hour period) & soil types play a large role here.

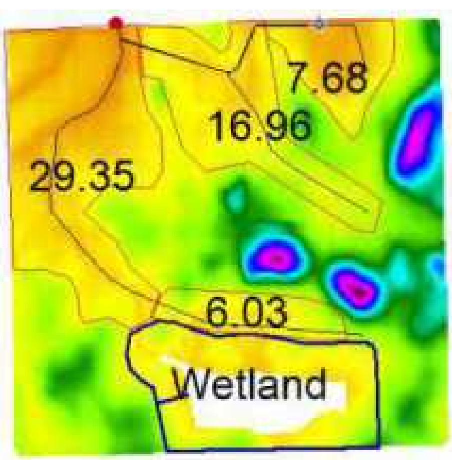
Using the Flow Accumulations, Main Ditches, Boundary templates and any custom Tile Worksheets you may have.

For this project, a 1/4" drainage coefficient and using the idea that the pipe will always be at a minimum grade of 0.10%, we are going to write down a few numbers so we are not jumping back and forth to the calculator.

At this point, you may want to use a combination of paper and software for taking notes.

In this example, we are draining about 65 acres total

NE—Hole is 11 acres—From flow accumulations & 7.68 acres from boundary



>>>> THANKS <<<<<

The values in this chart are copied for the "Pipe Size & Acres Drained Calculator" produced by Prinsco & University of Minnesota Extension

Acre Capacity @ 0.10% Grade

Tile Size	Draingae Coefficient		
	1/4	3/8	1/2
3	2.3		
4	5	3.2	2.5
5	9	6	4.2
6	15	10	7.4
8	32	21	16
8 dw	48	32	24
10	50	34	25
12	83	57	42
10 dw	85	58	43
15	130	85	64
12 dw	140	94	70
18	210	140	100
15 dw	250	170	130
18 dw	410	275	210
24	420	295	220
24 dw	900	600	420

dw = Dual Wall Pipe

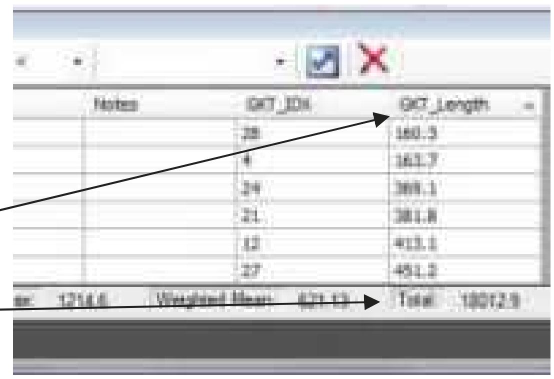
Creating Tile Plan—Drawing In Sized Tile

You should now have all the pieces of the puzzle and be able to draw out your tile plan.

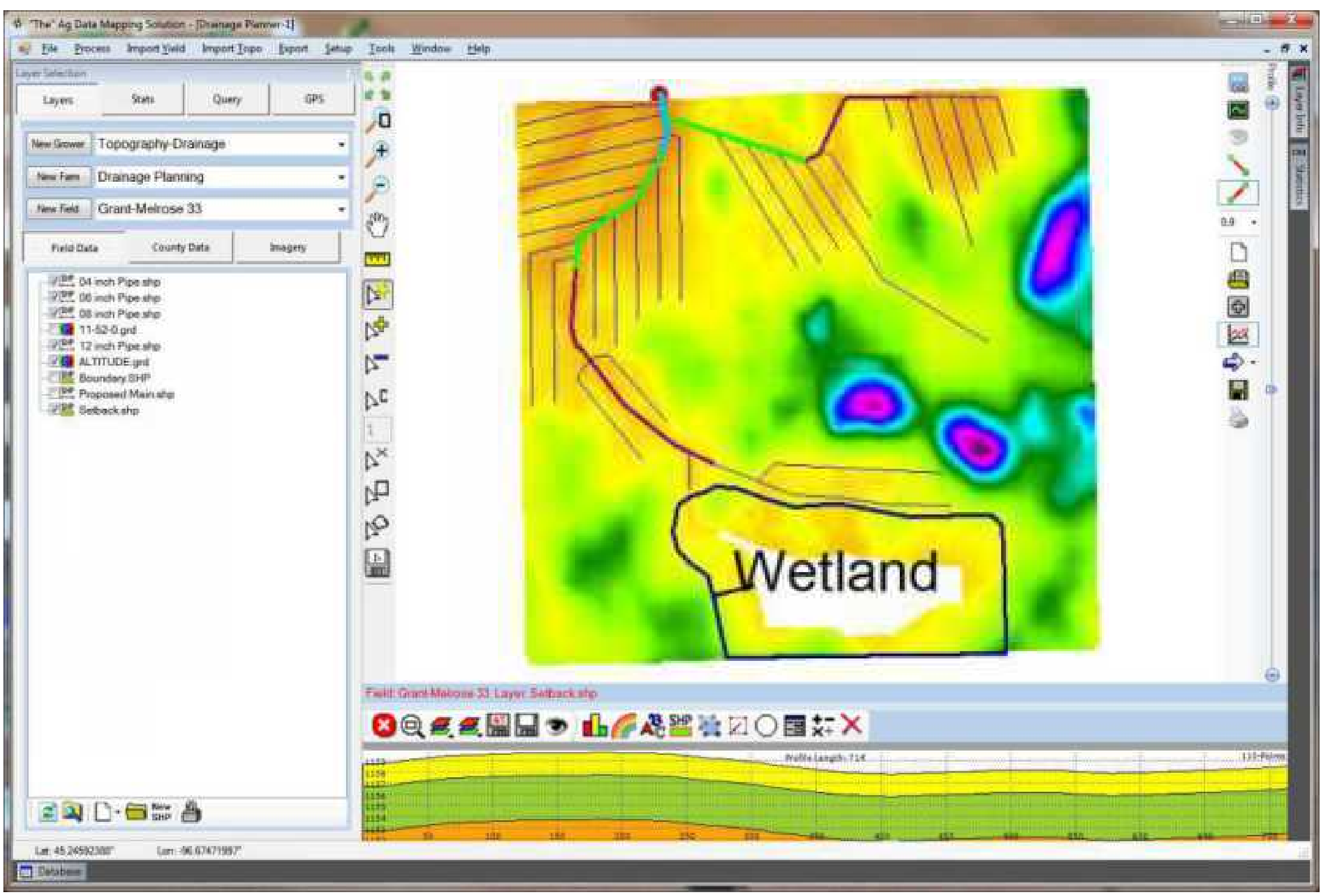
We recommend drawing in the smallest size pipe first. This helps provide direction on where to more appropriately place the mains on the plan. Also, calculate a "Distance" value i.e. 4" tile @ 1/4" Drain Coefficient & 0.1% grade.

5 ac x 43,560 (sq ft/ac) = 217,800 / 100 (tile spacing) = 2,178 (Max footage for 4")

1. Turn on all the layers you need to draw in your tile lines & zoom to the desired area.
2. Click on the "Create Layer for Templates" button.
3. Choose the correct tile size.
4. Check the tile size in the field data.
5. Click on the "Draw Layer".
6. Draw in a tile line.
7. Repeat 5 & 6 until done with this tile size & "save".
8. Go to step 2 for the next tile size.

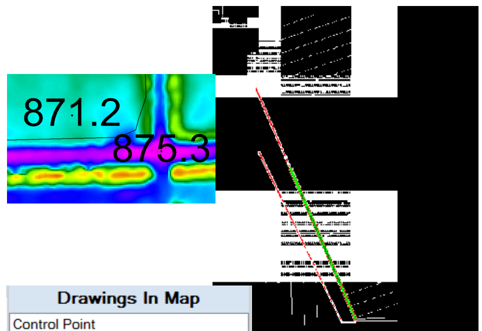


Return to "Map Window" - Turn on pipe size
Click on the "Database" tab
Click on column header "GKT Length"
Bottom of the window, "Total" Feet of Pipe

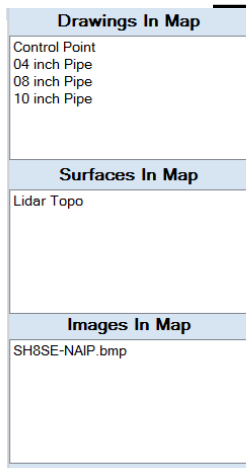


ADMS—AGPS Export

Introduction: These instructions will walk you through sending complete plans out to AGPS controller. These files will allow you to utilize Control Points, Background Images, Steering & "PTL". The information below requires that you have collected / created the following.

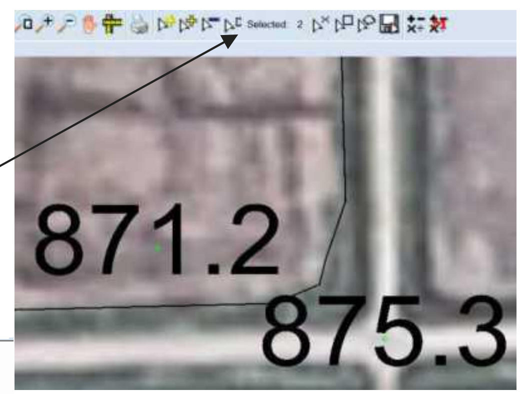


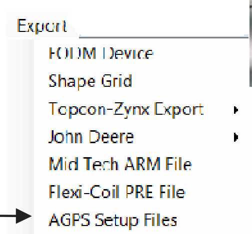
- Control Points or Points file that contains Control Points.
- Tile plan (4"-8"-10" & so on) created that is projected to match Control Points
- Lidar.grd or RTK Topo.grd used to create the Tile Plan projected to match Control Points
- "Print Map to Bitmap" - BMP / BPW created to work with plan



Exporting data to AGPS:

1. Open "Map Window"
2. Turn on all "Drawing / Surfaces / Images" to be exported, this would include the "Topography.grd" that was used for design
3. Open the "Points.shp" that CONTAINS the Control Points
4. "Select" all the "Control Points" for this field / project (example —2 control points)
5. Menu Bar—Export—"AGPS Setup Files"





This will open the "AGPS Setup Wizard"

Instructions on this page will tell you what to do. The next couple pages of the book are "step by step" instructions with "Notes" & "Suggestions"

Click "Next"

ADMS—AGPS Export

6. Choose the “Drawing Layer” that contains “Control Point”

    - Assign the Database Column

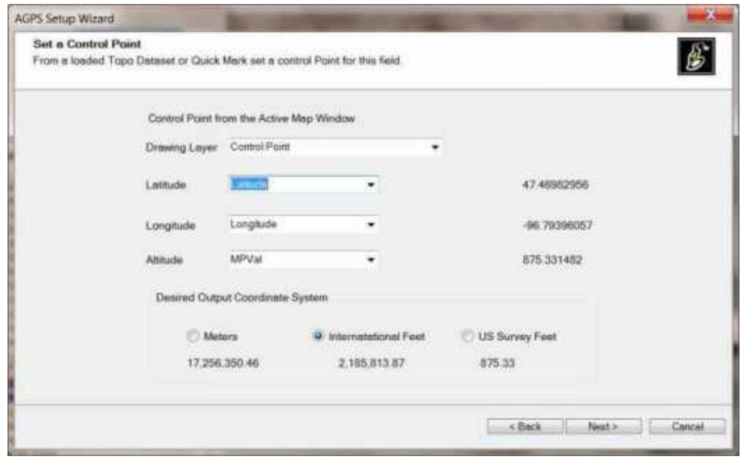
        - Latitude

        - Longitude

        - Altitude

    - Choose the Coordinate System of the “Tile Plow” AGPS PC

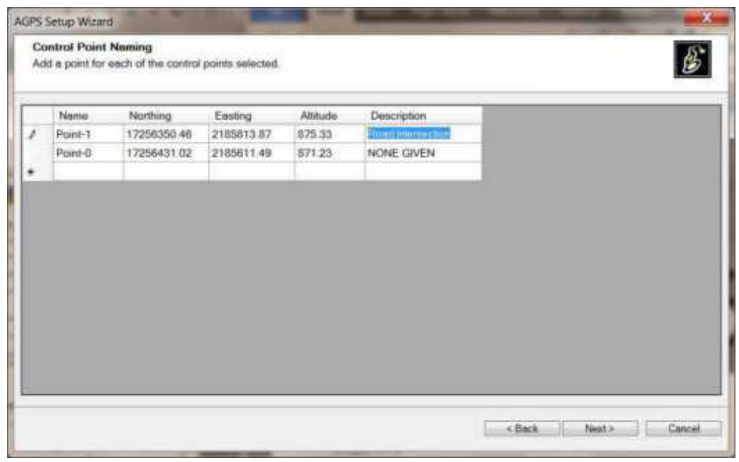
Click “Next”



7. Under the “Description”, Name or Describe each Control Point. Make it something meaningful to the Tile Plow Operator.

    Note: these were your “Selected Points”

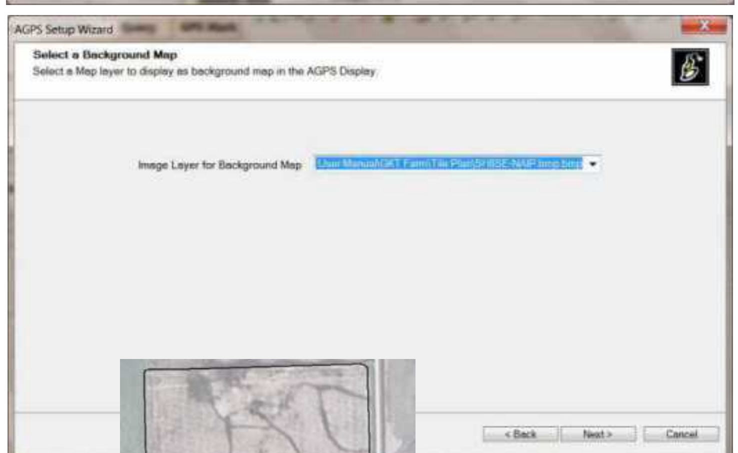
Click “Next”



8. From the drop down list select the “Print Map to Bitmap” background image.

Suggestion : If you are using “Steering Lines” or loading all the “Tile Lines” - DO NOT do a BMP with tile lines on it. Suggest using BMP WITH Control Points and Labels as shown.

Click “Next”

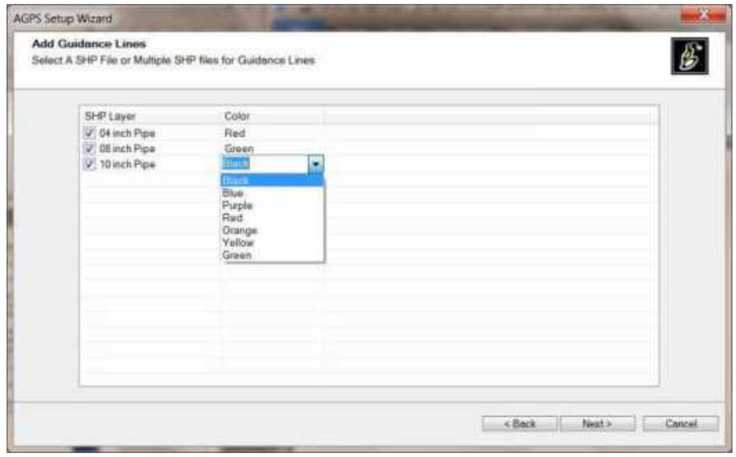


ADMS—AGPS Export

9. Check on the tile lines you want exported and assign color for the “Tile”

Suggest: Looking at your tile lines in the software and matching colors as close as possible. May be slightly different due to limited color “Names”.

Click “Next”

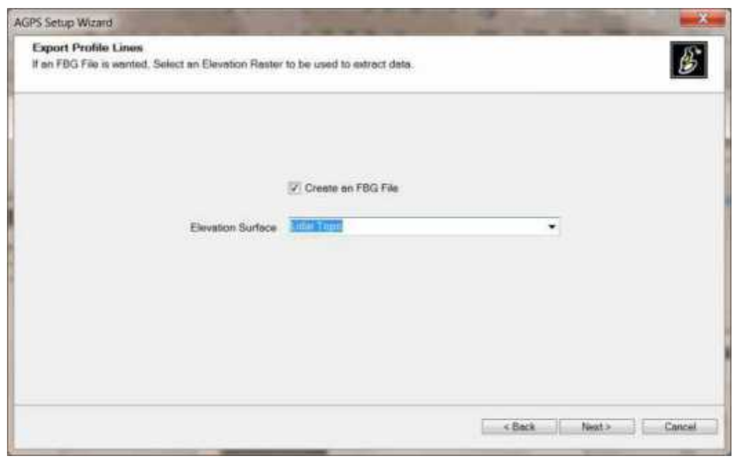


10. Choose the Surface.grd that you used in the “Drainage Planning” window to create your “Profile Lines” and tile design.

- Checking the “Create an FBG File” will create a file for AGPS which will allow PTL.

Note: These elevations will be created based off the xxxxx.grd and pull / extract values from under the tile line in previous step.

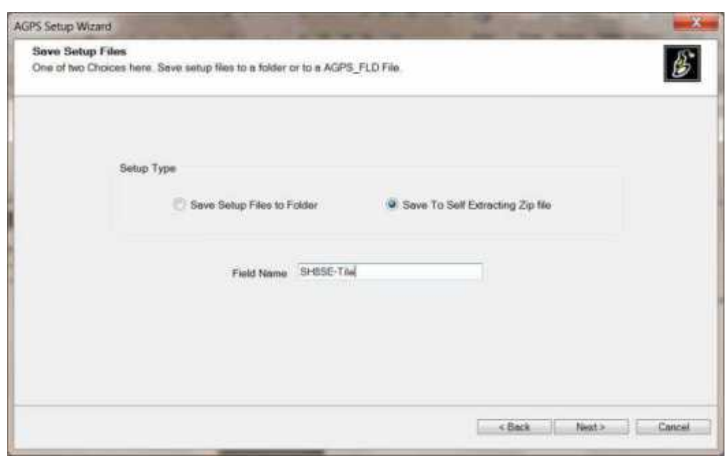
Click “Next”



11. Choose “HOW” you want the files saved and assign “Field Name” (Name they will see on AGPS)

- *Choosing “Save Setup Files to Folder” will put all the AGPS compatible files into a folder at your set location.*

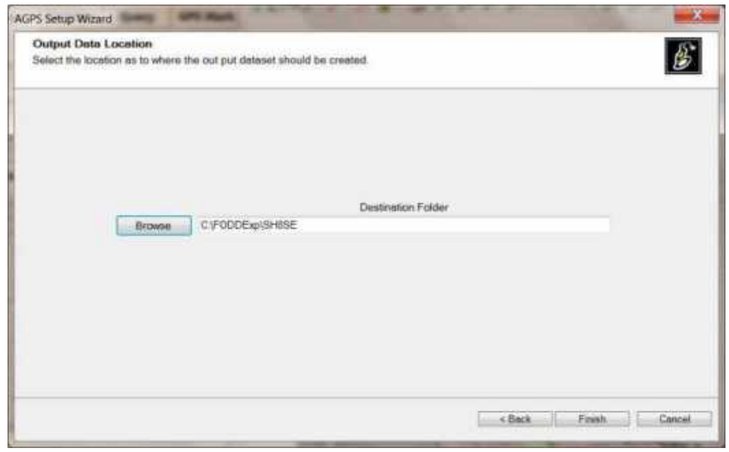
- ***SUGGESTED****: Choosing “Save To Self Extracting Zip file” will put all the files in an xxxx.exe file that will automatically put all the files into the C:/amw/data folder on AGPS-PC.*



Click “Next”

ADMS—AGPS Export

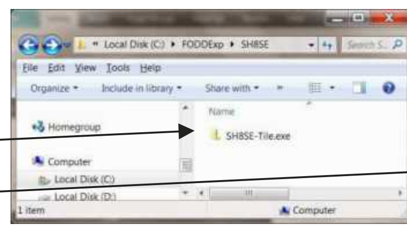
12. Choose a folder to put these files into.

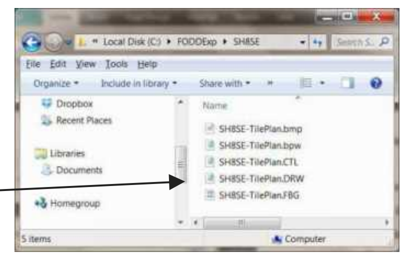


Consider sending the files back to the Default C:FODDExp & create a "New Folder" named the "Field Name"

Note: This folder must be "EMPTY" this process will not work if there is any data in the folder.

Click "Finish"



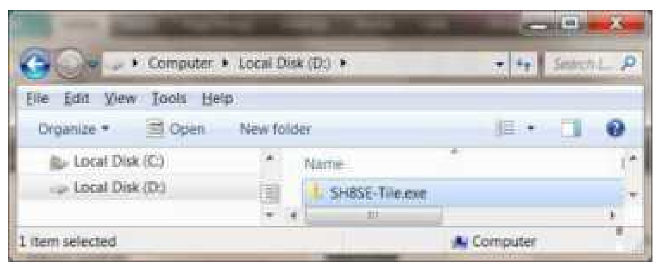


You will get files similar to **ONE** of these

Left = Self Extracting

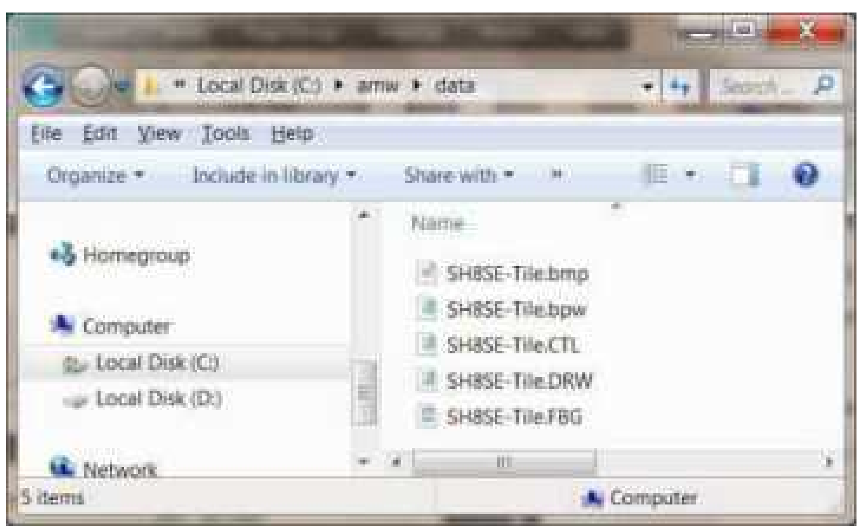
Right = Files to Folder

13. Copy the xxxx.exe or the files over to a USB device to take to the tile plow.



Using files in the Tile Plow:

1. Insert USB
2. Double Click on the xxxx.exe file
3. All the files are now created in the C:/amw/data folder



Processing Yield Data

As we make our transformation from a package specifically designed for drainage maps, we will be counting on help from some external tools to extract from proprietary data sources and filter data.

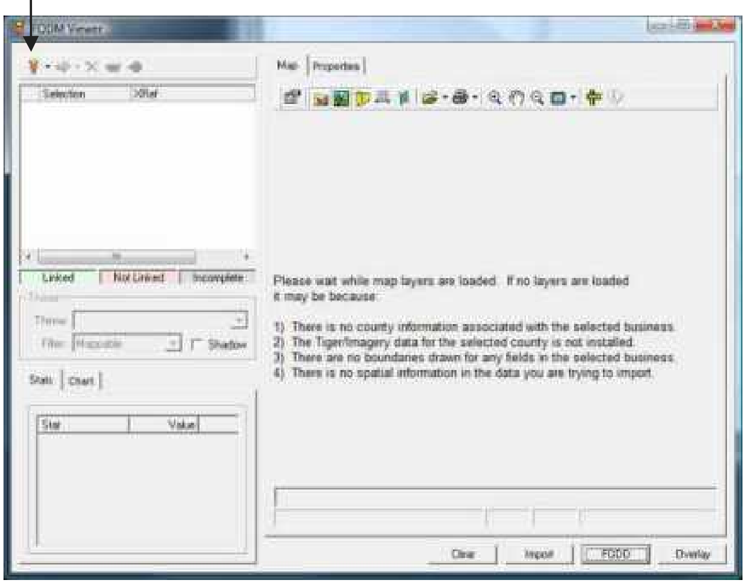
Though this arrangement may seem clumsy, it is the process we have used in house to create yield maps for quite some time.

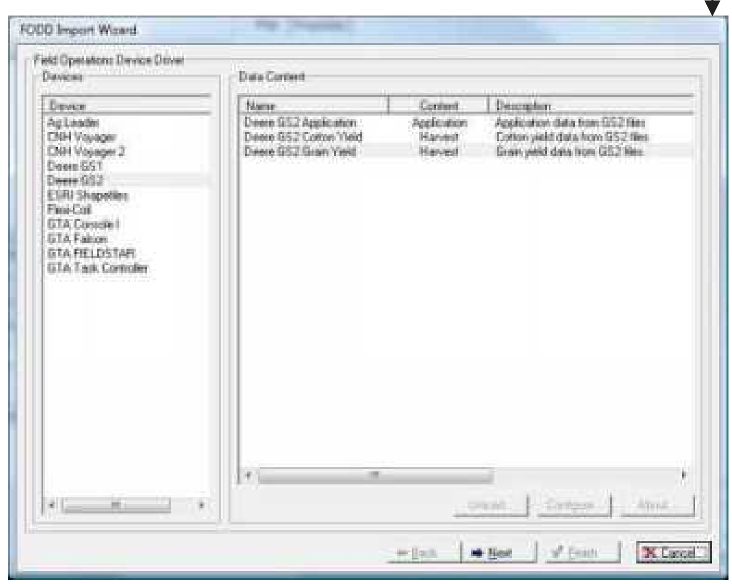
The tools we will be using to access data from John Deere Greenstar 1&2 systems, the original **Ag Leader YLD** as well as Insight data, and Case Voyager data, is the **FO-Viewer** tool from **Mapshots** that is installed with the FODD runtime.

In **Ag Data Mapping Solution** you can start FOViewer if it is installed by clicking ***Import Yield & Launch FOViewer.***

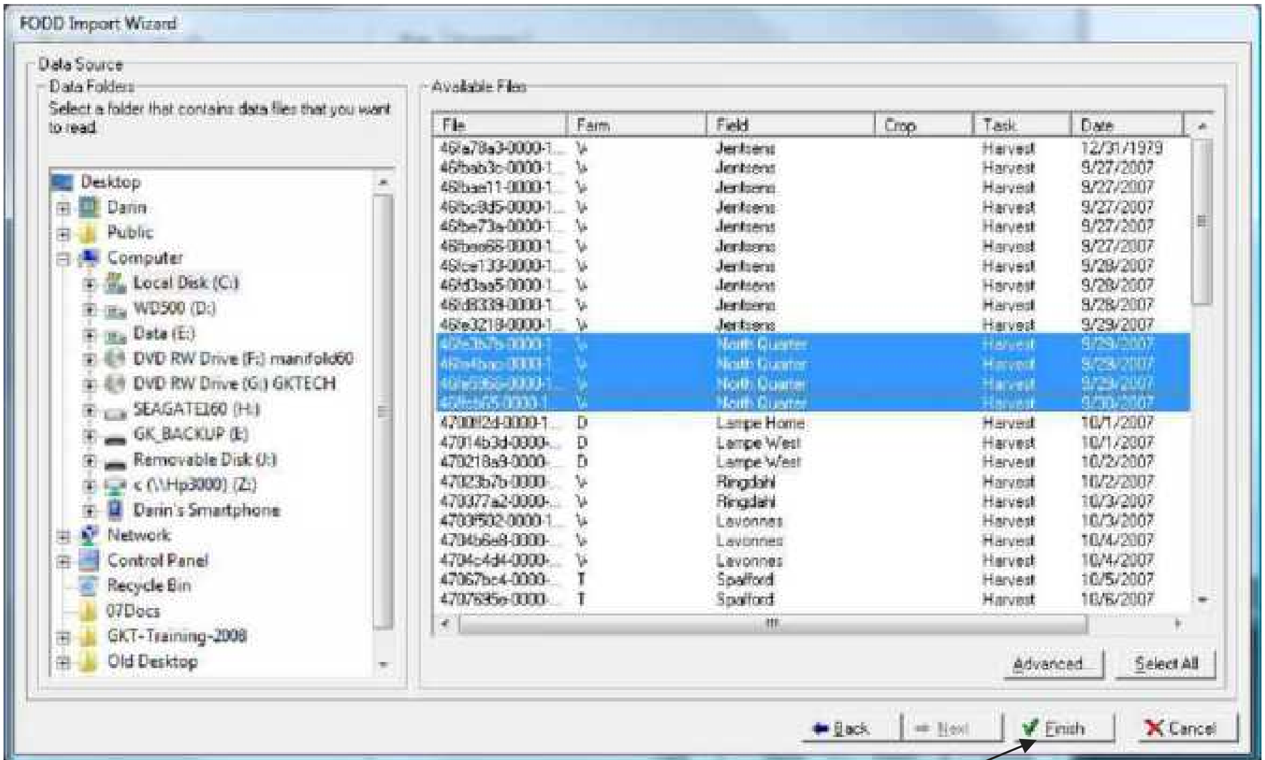
FOViewer will startup in the "Device Selection" menu ready to import data. That will bring up the box below right that will show a list of devices from which data can be read. Highlight the device type you wish to read from and the type of data you wish to read, for example Deere GS2 and Deere GS2 Grain Yield, then click **"Next".**

If you need to re-access the "Device Selection" menu, click the arrow to dropdown a menu.

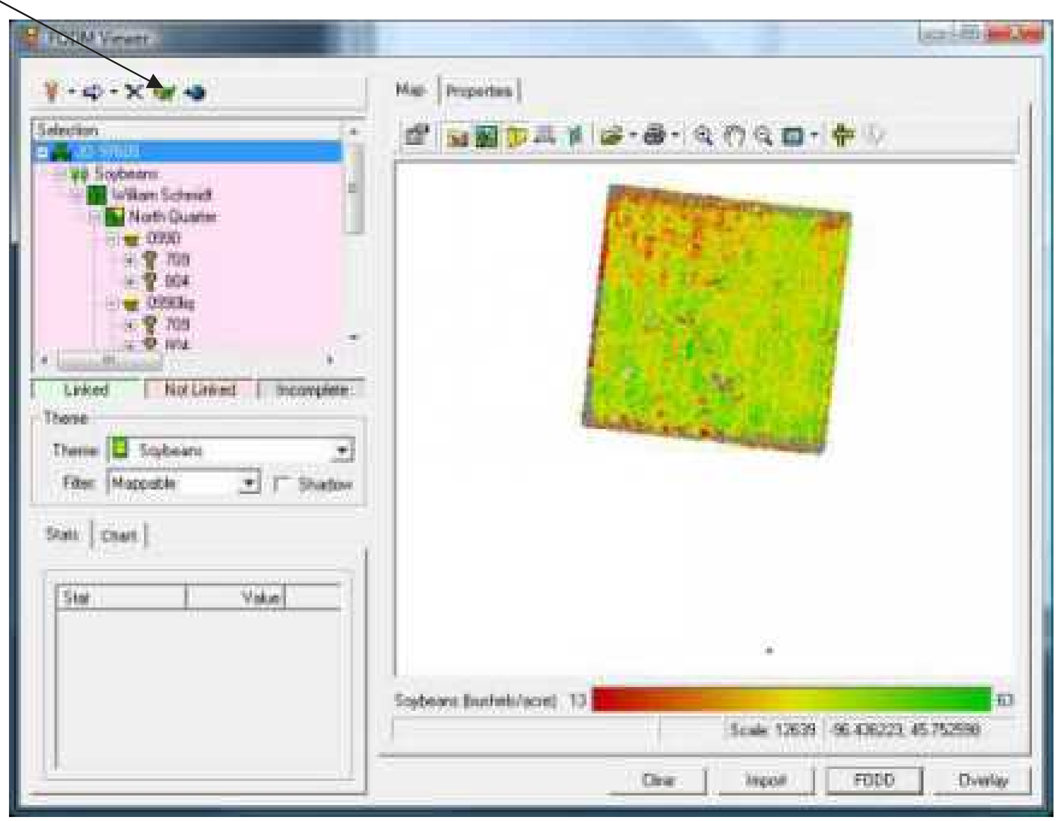




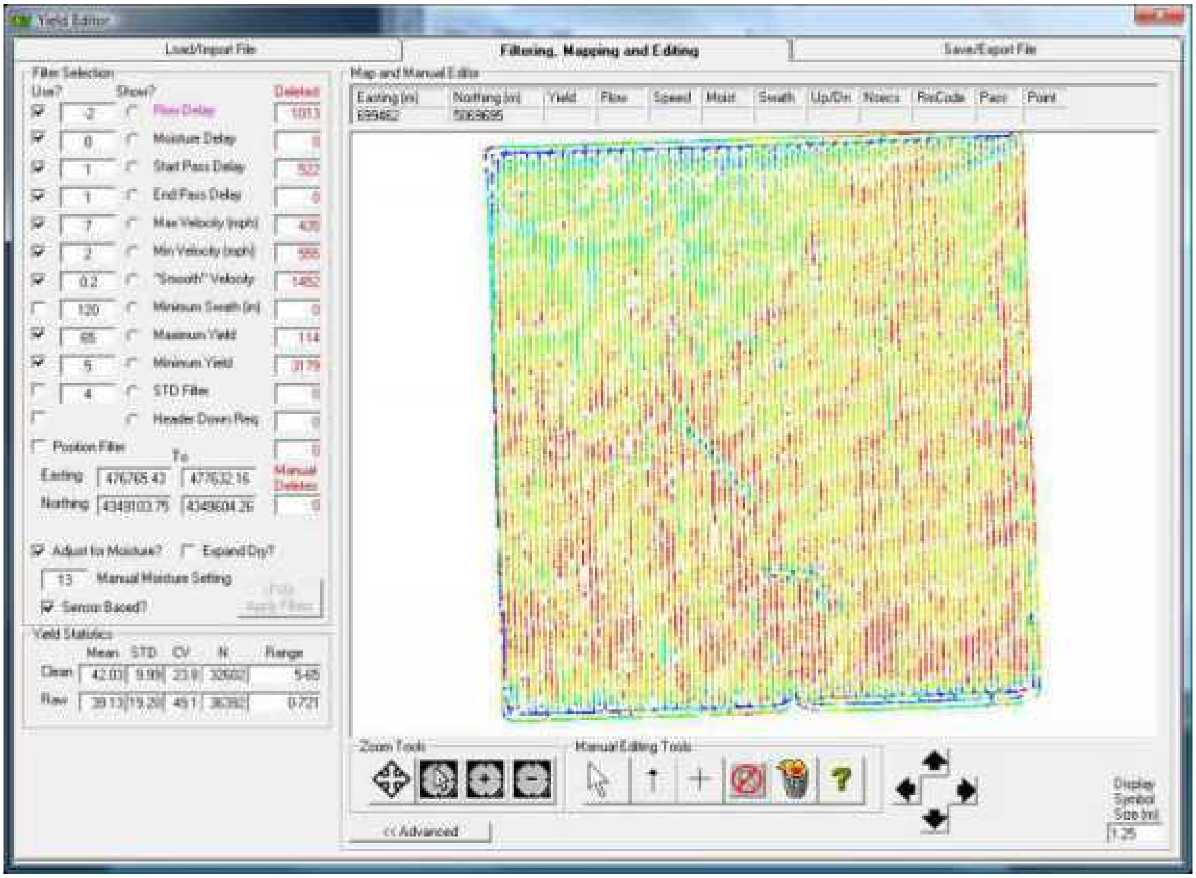
Processing Yield Data



The Farm has been intentionally blocked out, but you can see that a field called North Quarter has been selected for processing. Click ***Finish*** to bring up the data. Then click the ***USA icon*** to open the field in Yield Editor.

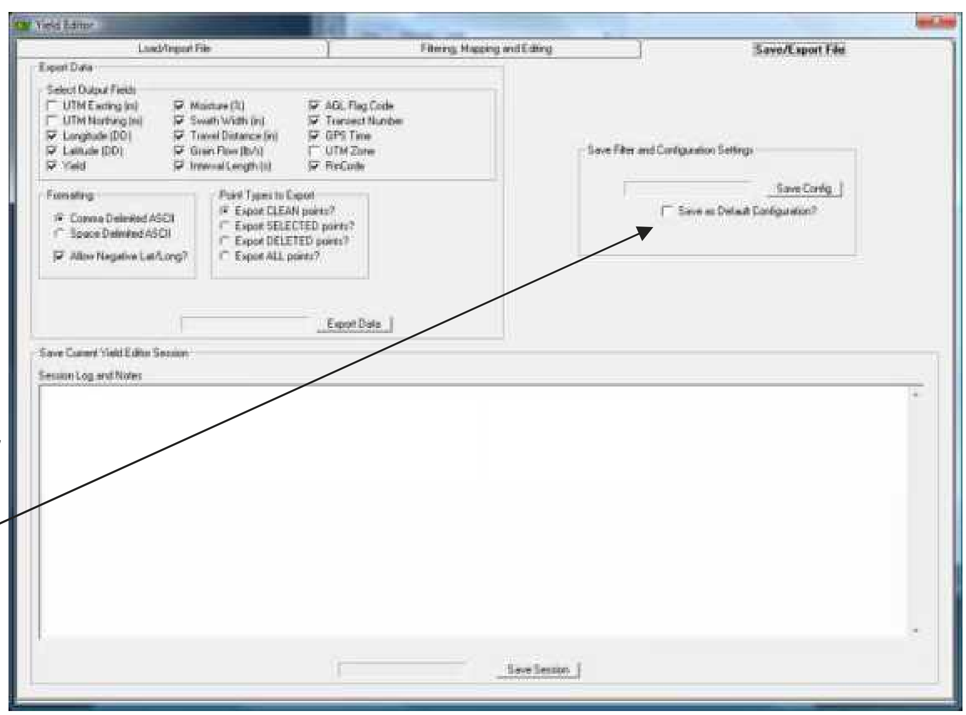


Processing Yield Data



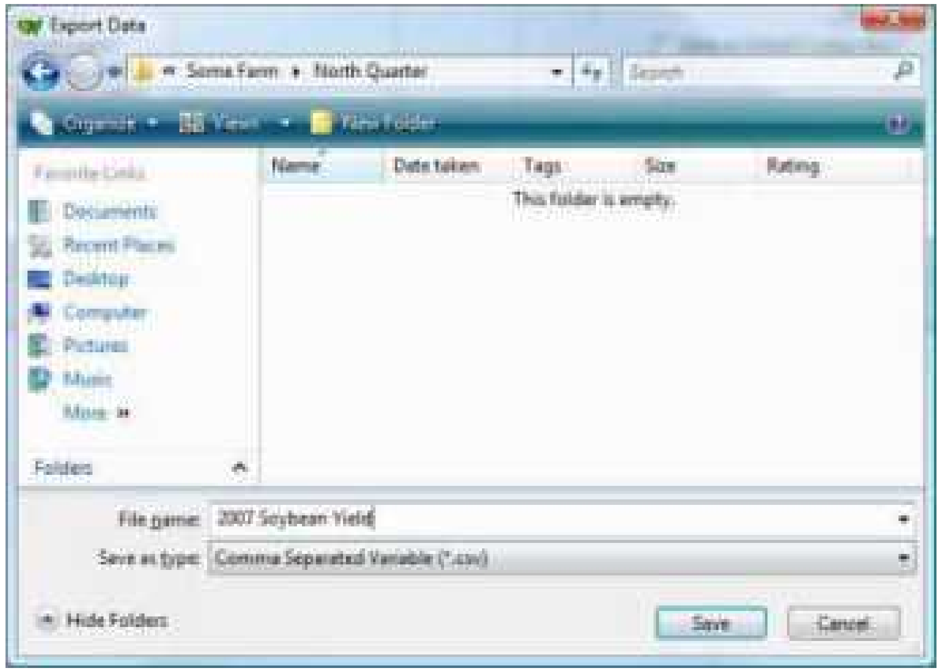
You can see above we have used the Yield Editor Utilities to clean nearly 4000 errant points from the yield data set. And we have adjusted the flow delay by two seconds to precisely align a ditch crossing in the data.

The last step is to export the data to a field folder in Ag Data Mapping Solution. To the right are the proper settings to create the CSV that Ag Data Mapping Solution is expecting. All Output fields except the UTM fields should be selected. After setting the export options as they are shown to the right, check the box labeled ***"Save as Default Configuration?"*** and then click **"Save Config."**

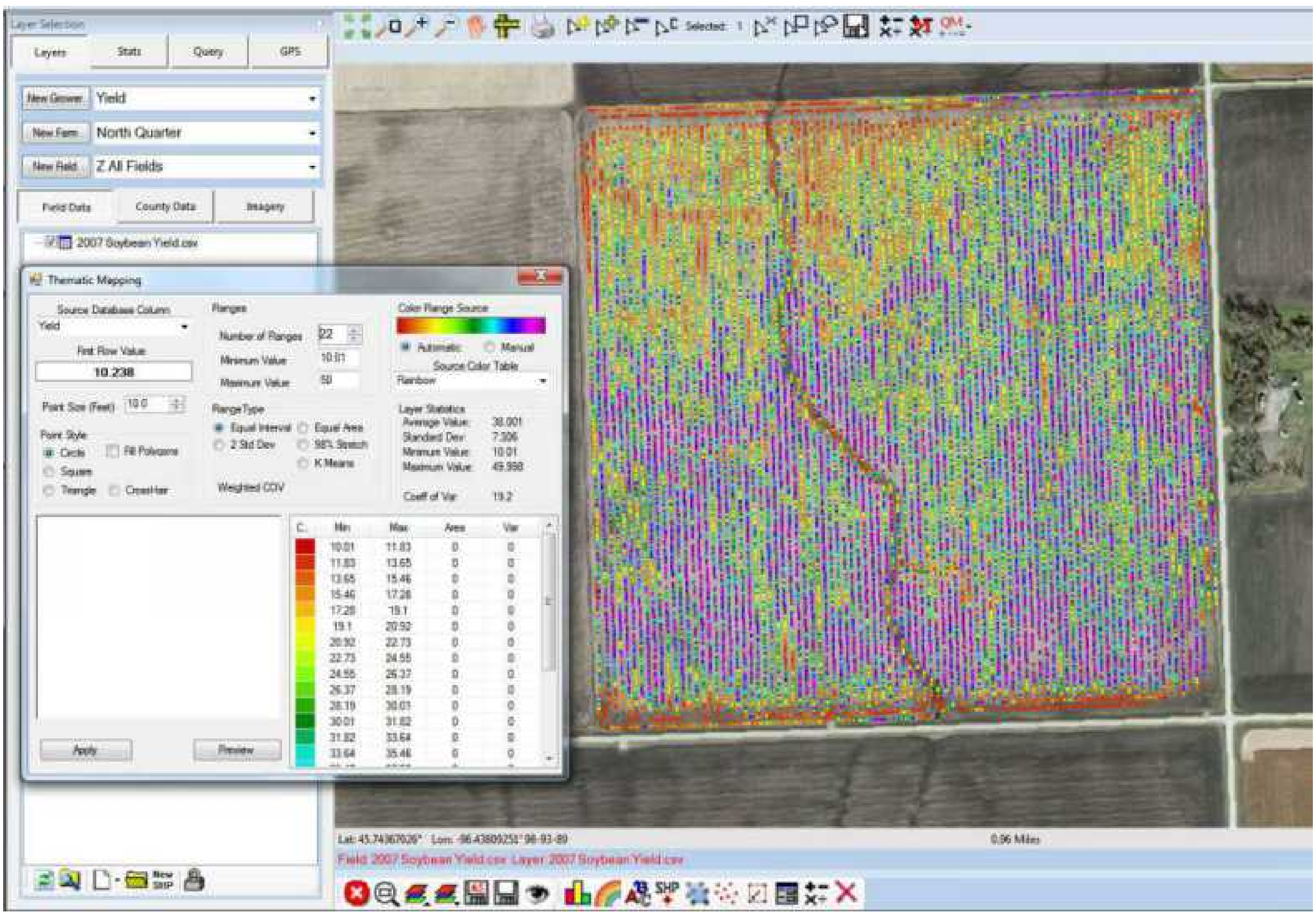


Processing Yield Data

Browse to the proper field folder for the data and click ***"Save"***.



You now have a properly cleaned yield data set that you can use, bring up in Ag Data Mapping Solution and set a thematic color table for displaying points.

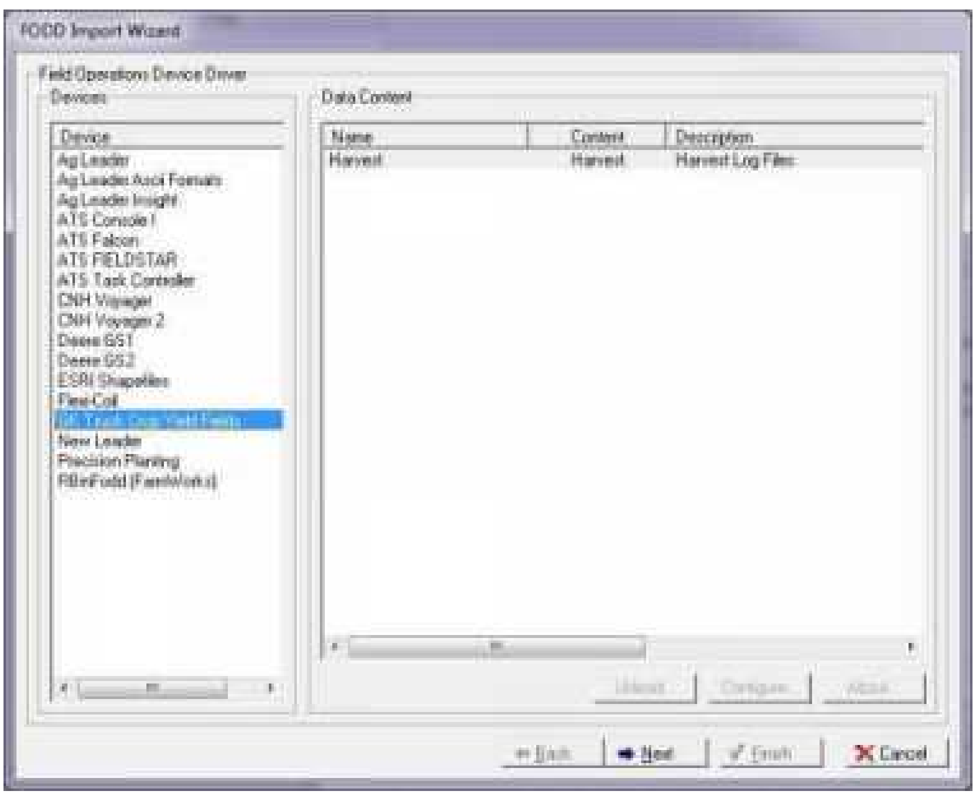


Importing KB/GK Yield Data

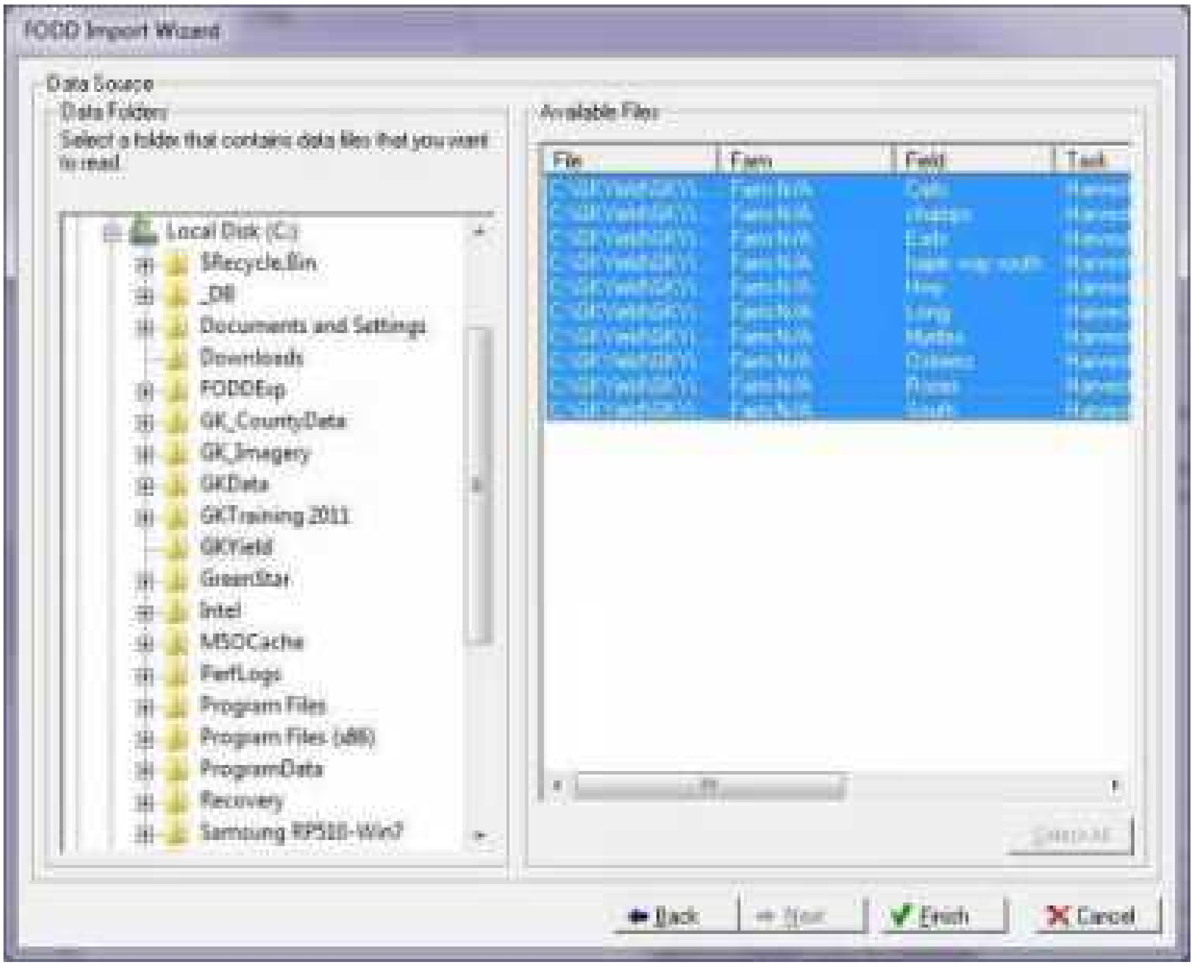
Beet / Potato Yield data is stored in the C:/GKYield folder on your PC you use in the harvest tractor. Data is actually stored in a file called GKYield.mdb, the raw MDB file has Yield and Topography. To access the Topography data you will need Microsoft Access. The yield files can be processed on tractor PC or copied off and processed on a different computer. If moved, I suggest moving the whole GKYield FOLDER and re-naming the folder to "GKYield2011" for example to identify the crop year.

To process this data you will need to have 4 pieces of software installed.
- GK ADMS—Ag Data Mapping Solution
- FO Viewer
- GK Truck Crop Yield FODD
- Yield Editor

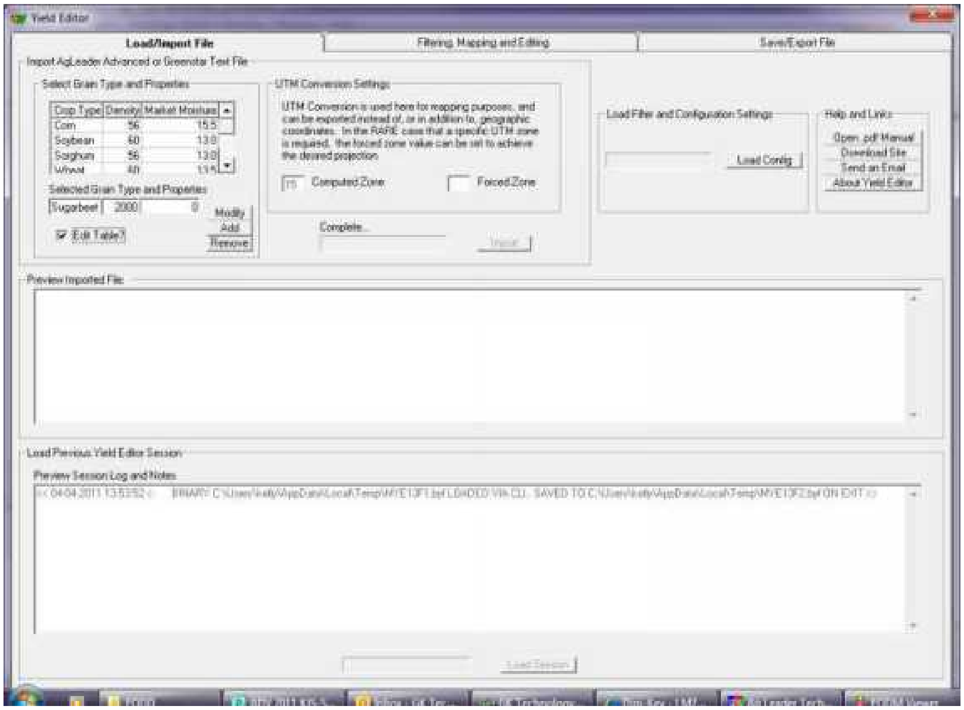
More coming—Not finished with the KB / GK Yield Section...

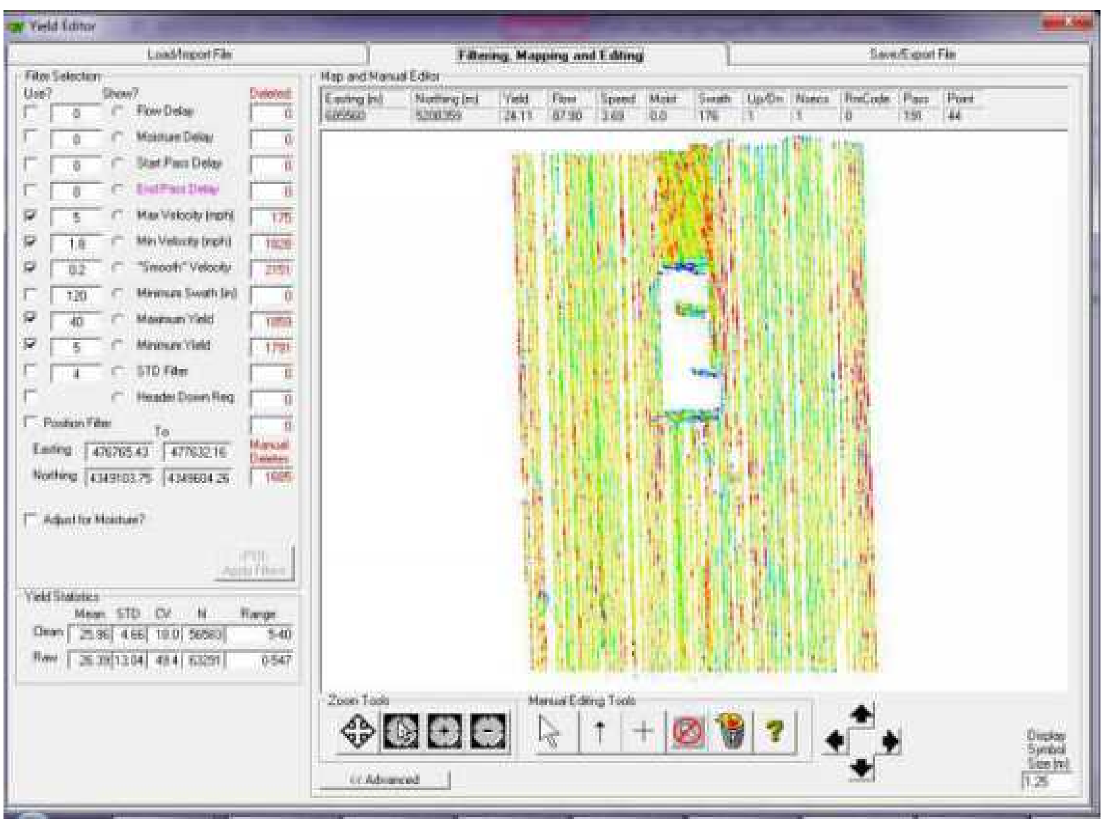


Importing KB/GK Yield Data

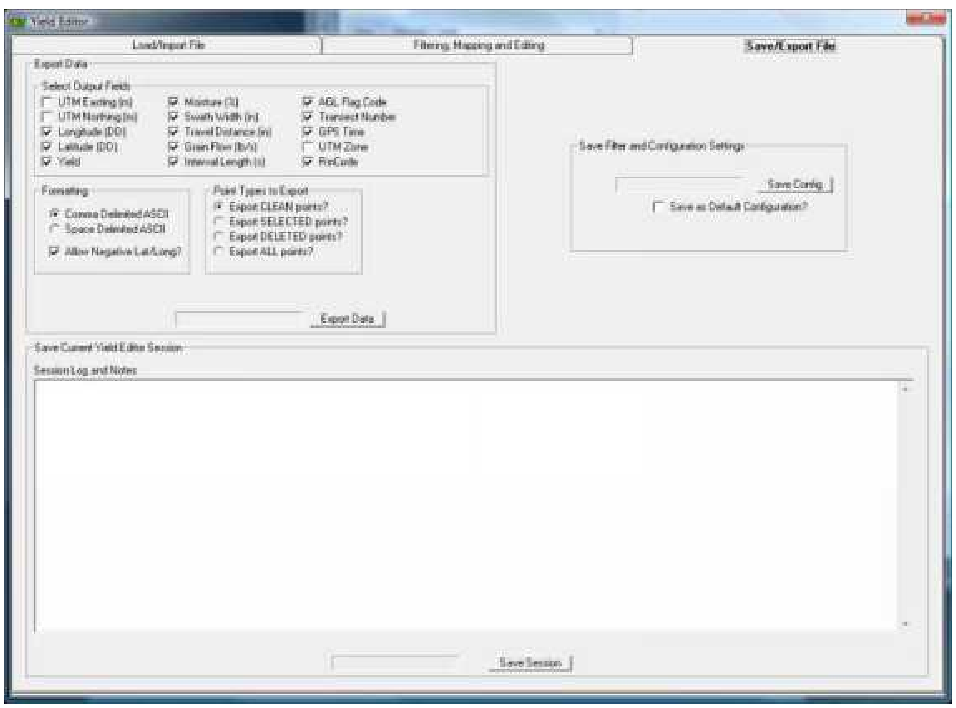


Importing KB/GK Yield Data





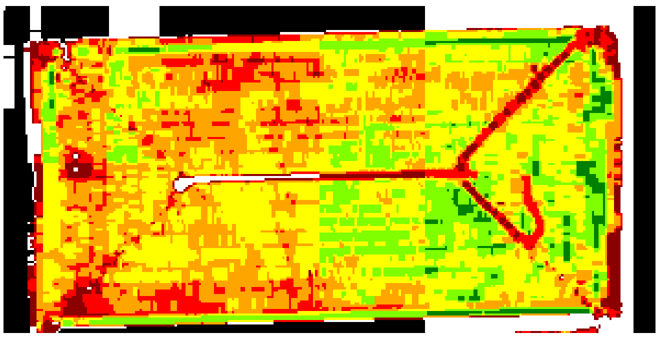
Importing KB/GK Yield Data



Cleaning Yield Data in Ag Data Mapping Solution

The best place to clean yield data is in "Yield Editor". Unfortunately, there are times that data will come to you in a SHP file or CSV file that can not be taken back to "Yield Editor". To clean up the data, you will have to use ADMS. We want the data in a "Points.shp" file format if you are exporting from another software package.

All of the following work will be done in "Map Window"



The file used in this example came out of APEX 2.7. Take note of the problems with this example.

Problems—

1. When data came into APEX it automatically merged the data sets. Assuming that they were "Calibrated". You can see the "Stripes" between the 2 combines that were "Race Tracking" each other. APEX Default map to the Left.

2. Both combines have the same "Machine" & "Operator" names. This makes it almost impossible to separate the two machines. Luckily the "Implement1" is different between the two machines (grain header vs flex head).

<u>Separating Data Sets-</u>

1. Import or Save SHP or CSV files back into the ADMS—GKData/client/farm/field structure.
   Note: We prefer the SHP file format from most software. There are some exceptions.

2. Turn on the Yield File for the Field (SHP or CSV).

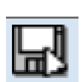
3. Go to the bottom left corner and open the "Database" tab. Look through the columns to find an item that will allow you to "Identify" each combine.
   In most cases, "Machine" or
   "Unit ID" will work

4. In this example, the "Implement1" column has 2 unique values Flex Header vs Grain Header

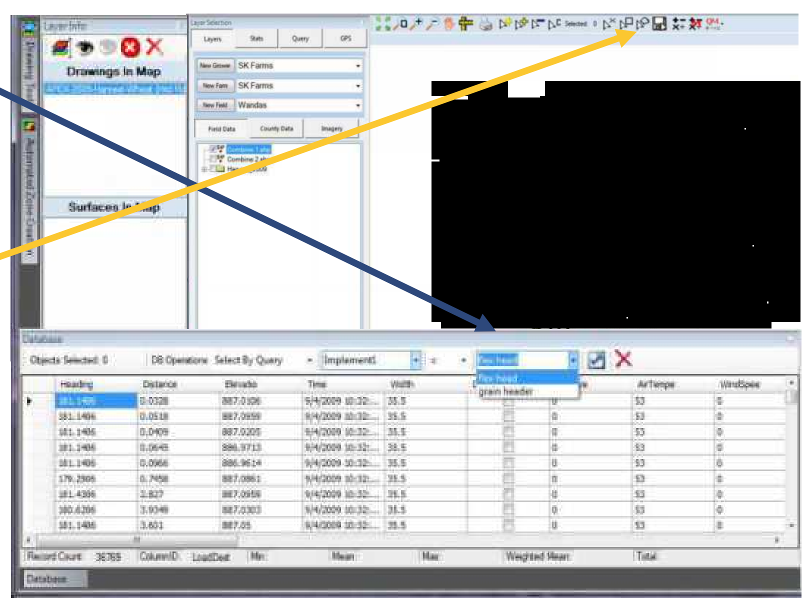
5. Use the "Select By Query" and select to "Implement1" and "=" to and "flex head"
   You will use your unique column.

6. Click the "Blue Up Arrow" to Run Query

7. Click on the "Save Selected objects to New Layer" top Toolbar (name Combine 1.shp)



8. Repeat 5-7 for Combine 2



Cleaning Yield Data in Ag Data Mapping Solution

Now we have two combines in separate SHP files. You may need to clean up data.
This Example—Combine 1 & Combine 2

** If the data is cleaned up when it comes into ADMS, skip the "Cleaning Data" below.

Cleaning Data—Query Tools:

1. Turn on "Combine 1.shp"

2. Open the "Database" tab and select the "Yield" column (Dry Yield in this example)

3. You will notice the values on the bottom toolbar. 0 - 265 bu/ac—Avg 58.4 bu/ac. You will need to select the values to clean the data up to.

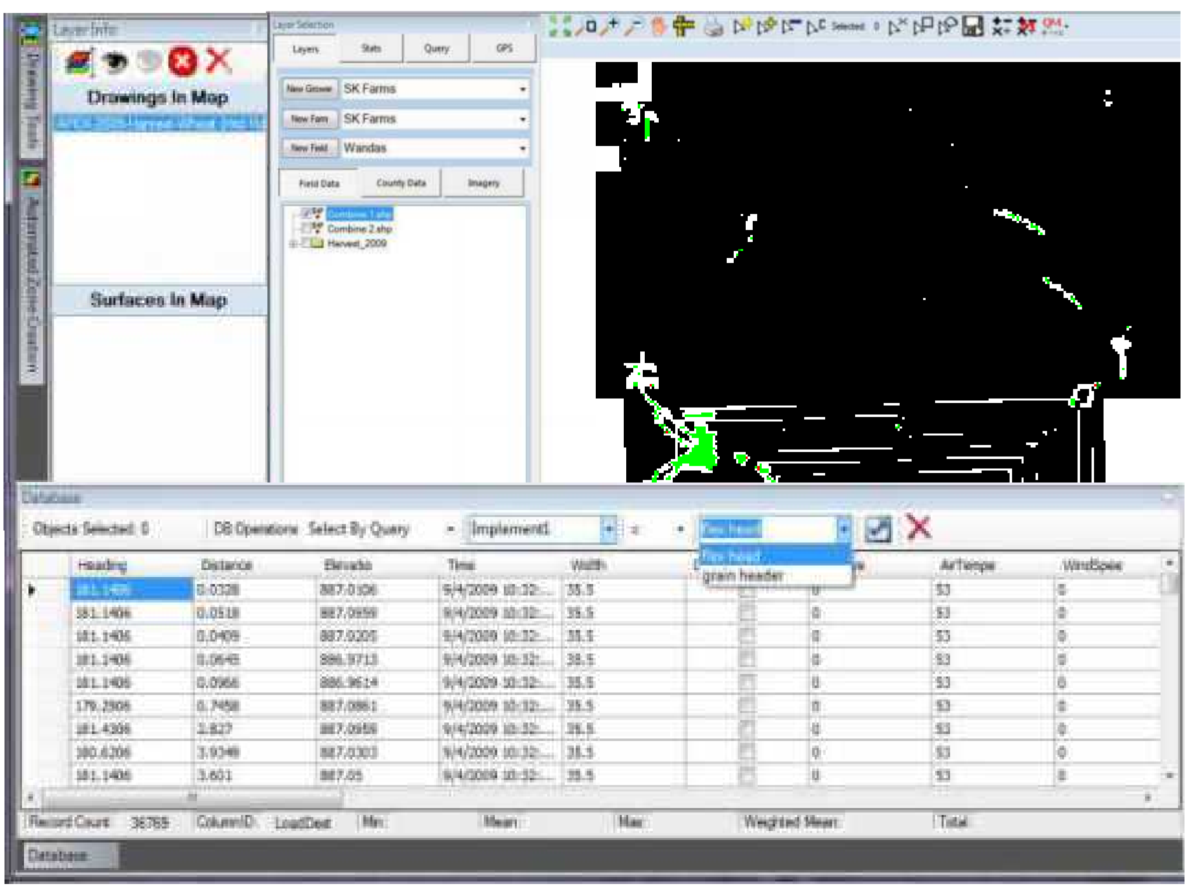
4. Use "Select By Query" and "Less Than <" and for this example using 20 bu/ac "Run Query"
   - Click the "Delete Selected Objects"

5. Use "Select By Query" and "Greater Than <" and for this example using 90 bu/ac "Run Query"
   - Click the "Delete Selected Objects"

6. Save the SHP file when finished. *(Optional -"Save As" name it "Combine1Cleaned.shp" keeping original data)*

7. Repeat steps 1-6 on "Combine 2" and "Combine 3" & 4 & so on.

Make sure you use the same values or value range (will affect normalizing, merging and color tables) (20-90 for this example or 30-100 be acceptable, value range of 70 for both)



Cleaning Yield Data in Ag Data Mapping Solution

Now we have two combines in separate SHP files. You may need to clean up data.

This Example—Combine 1 & Combine 2

** If the data is cleaned up when it comes into ADMS, skip the "Cleaning Data" below.

Cleaning Data—Selection Tools:

1. Turn on "Combine 1" (for this example)

2. Go to the bottom toolbar, Click "Thematic Draw Settings" - Adjust setting like "Thematic Mapping" below

   - Source=Yield - Ranges 21– Rainbow - 7 ft point size - Circle - Equal Interval

3. On the top tool bar, Click "Select Mode Add" and "Select by Rectangle" (or "Select by Polygon")

4. Draw a rectangle around data you want to delete. (note: "Selected: #" of objects-top tool bar)

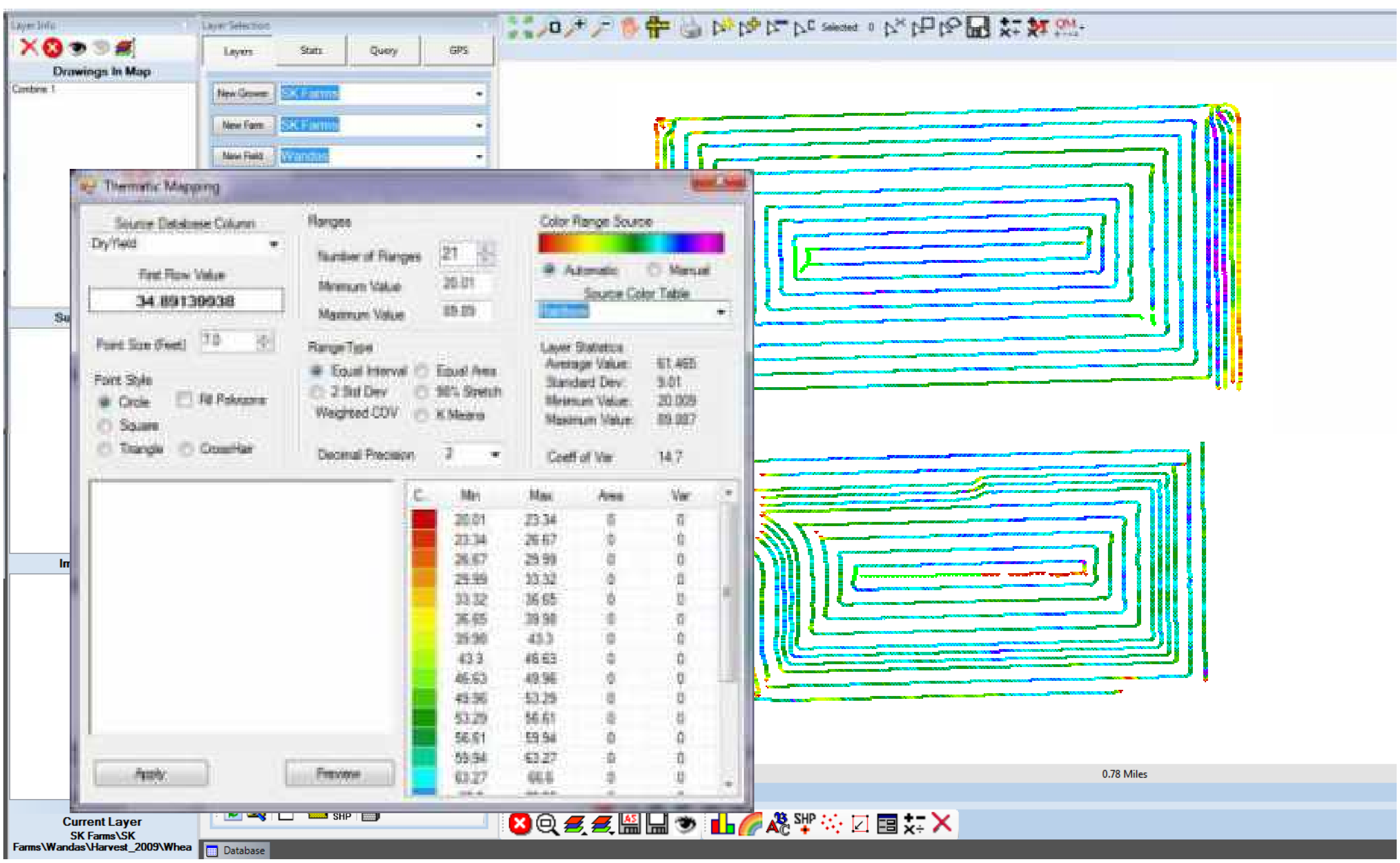
   Repeat step 4 to select more objects

5. Click the "Delete Selected Objects" button on the bottom toolbar.

   Repeat 4 & 5 as needed for this SHP file

6. Save the SHP file when finished. *(Optional - "Save As" name it "Combine1Cleaned.shp" keeping original data)*

7. Repeat steps 1-6 on "Combine 2" and "Combine 3" & "4" & so on.



Normalizing Yield Data

In normalizing yield data, there are two concepts to keep in mind

1. Data Extents or Data Range—
   GOOD—Combine 1 & Combine 2 cleaned up to 10 bu to 90 bu wheat
   BAD—Combine 1 cleaned up to 5 bu to 110 bu wheat
   Combine 2 cleaned up to 10 bu to 90 bu wheat
2. Data sets are coming from comparable or similar areas.
   GOOD—2 combines "following" each other will normalize and merge very well in most cases.
   BAD—Combine 1 harvested the East 80 and Combine 2 harvested the West 80, cropping history, soil types and drainage all could be major issues.

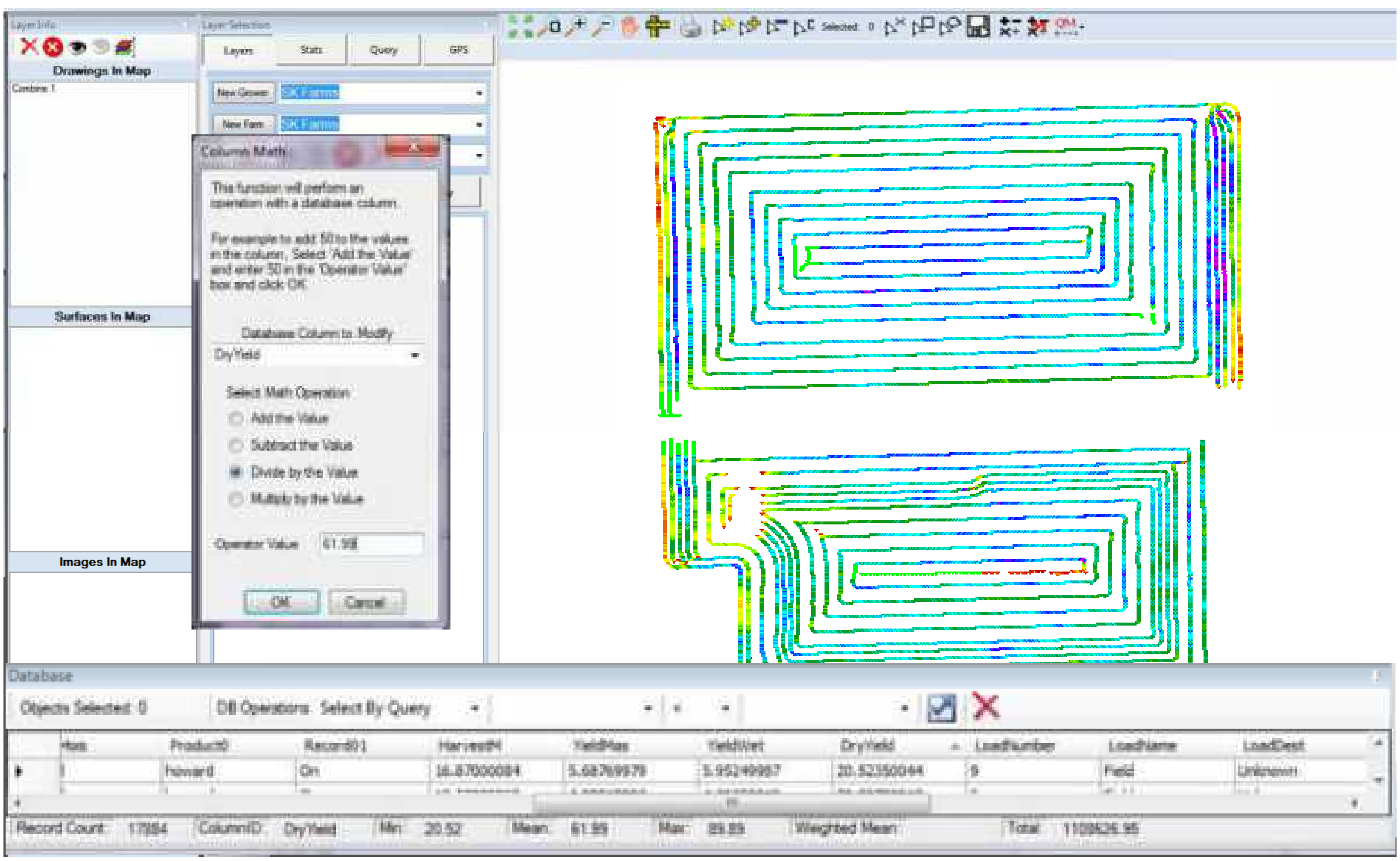
We are going to be working with data that is cleaned to meet the above specifications.
This Example—Combine 1 & Combine 2

1. Turn on "Combine 1"

2. Go to your "Database" tab in the bottom left corner

3. Find your "Yield" column and Left Click on the header (Dry Yield for this example)
   -*Take note of the "Mean:" value on the bottom of the Database*
4. Click on the "Preform Math Operation on a Column"
   -*Divide by the "Mean:" value (61.99 in this example)*
5. Go back to the "Database" click on the "Yield" column header
   -Take note of the "Mean" value now = 1 (if not 1, clear map and start over)
6. Click on "Save As" button & add "Normalized" to the name (Ex. Combine 1 Normalized.shp)

7. Repeat steps 1-6 on "Combine 2" and "Combine 3" & "4" & so on.



Normalizing Yield Data

The final step in Normalizing Yield Data is merging the data set & adjusting the data back to YIELD / ACRE

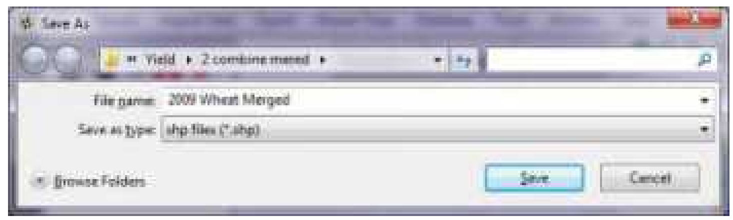
1. Start out by doing a "Clear Map" under the "Layer Info" tab

2. Turn on "Combine 1.shp" & "Combine 2.shp" & "Combine 3.shp" and so on.
   Only turn on the "Yield Data" (NO boundaries or images)

3. Right Click on either "Combine #.shp" file

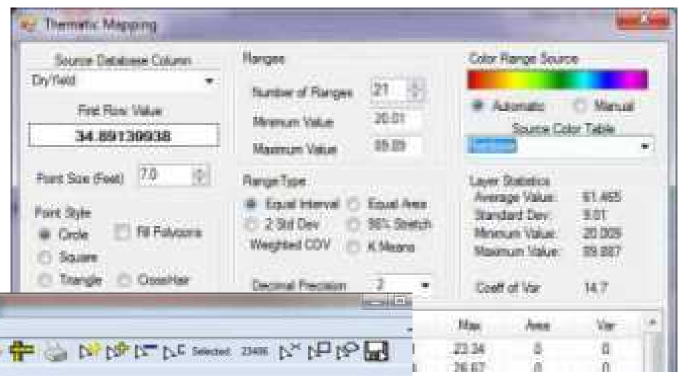
4. Choose "Utilities" and "Merge all Visible SHP files"

5. Set the "File Name" of the new layer to represent the "Year-Crop-Merged.shp".
   In this example "2009 Wheat Merged.shp"



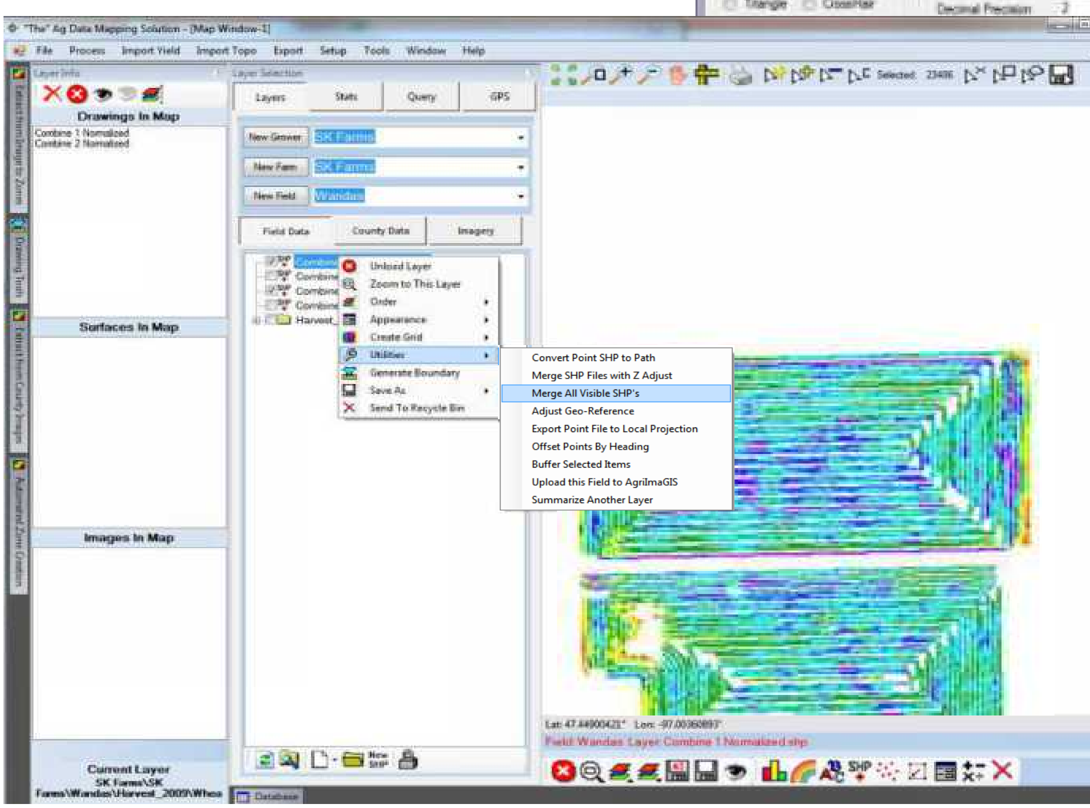
6. Turn on the New "2009 Wheat Merged.shp"

7. On the bottom Toolbar click the "Preform Math Operation on a Column"
   -*Multiply by the "Actual Yield" (Example 65 bu)*



8. Go to the bottom toolbar Click "Thematic Draw Settings" - Adjust setting like "Thematic Mapping"

9. Click on the "Save" button on the bottom toolbar



Create Grid from Polygon—Yield Data

You have now cleaned up your Yield Data in either ADMS or Yield Editor, and perhaps merged multiple combines. The Yield data is either in a .SHP or .CSV file format. This format is NOT ready for making management zones or use in scripts. You must have all your Yield Data for the field merged into one Shape File or CSV.

For Analysis:

1. Turn on the Yield.shp or Yield.csv. (example will be using Yield.shp)

2. Right Click on the Yield.shp

3. Choose "Create Grid" and "Create Grid from Polygons"

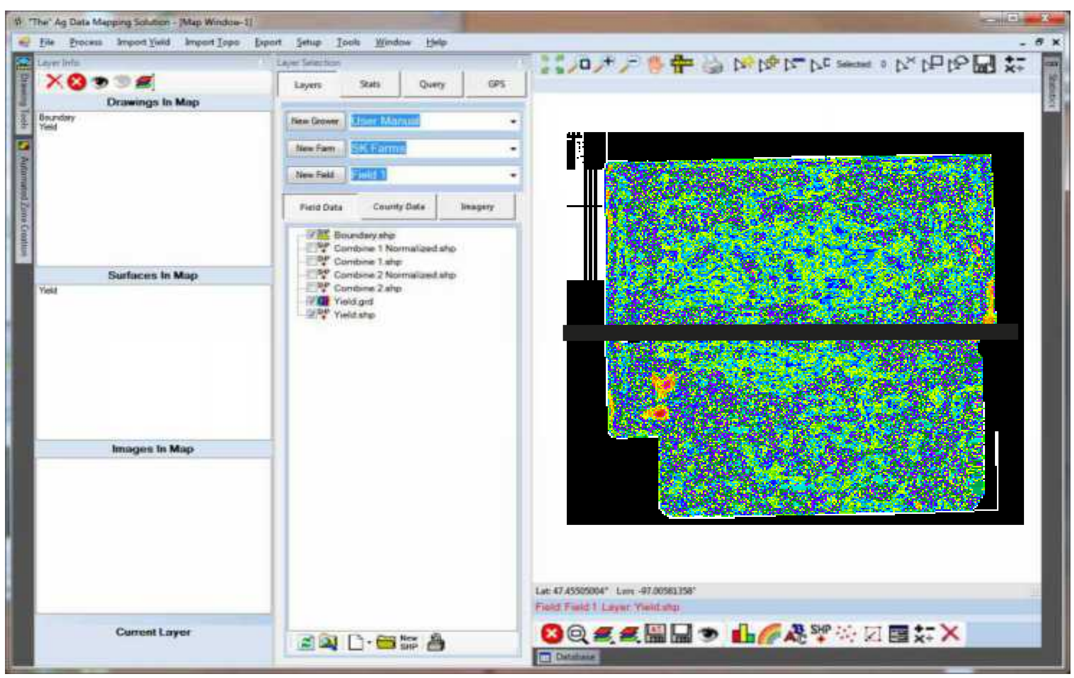
4. Click "Create Grid" button - *(stop at any step here for visual analysis)*
   Use the "Fill Null Values" button to fill in areas that don't have Yield Data
   Use the "Low Pass" button to smooth out the data (Suggest 2 or 3 clicks)

5. Once filled, Turn on the "Boundary.shp" - Left Click in map to "Select" it

6. Click on the "Yield.grd" file name to make it the active layer

7. On the bottom toolbar, click "Crop Raster to Selected Polygon"

8. Save the "Yield.grd" file

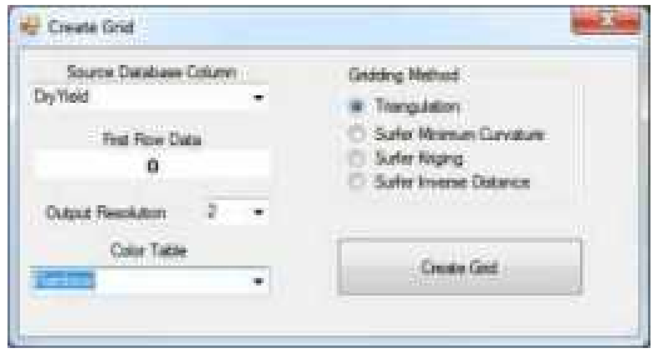


Create Grid from Points—Yield Data

This format is NOT ready for making management zones or use in scripts. You must have all your Yield Data for the field merged into one Shape File or CSV.

For Zones:

1. Turn on the Yield.shp or Yield.csv. (example will be using Yield.shp)



2. Right Click on the Yield.shp

3. Choose "Create Grid" and "Create Grid from Points"
    Adjust settings similar to image to right

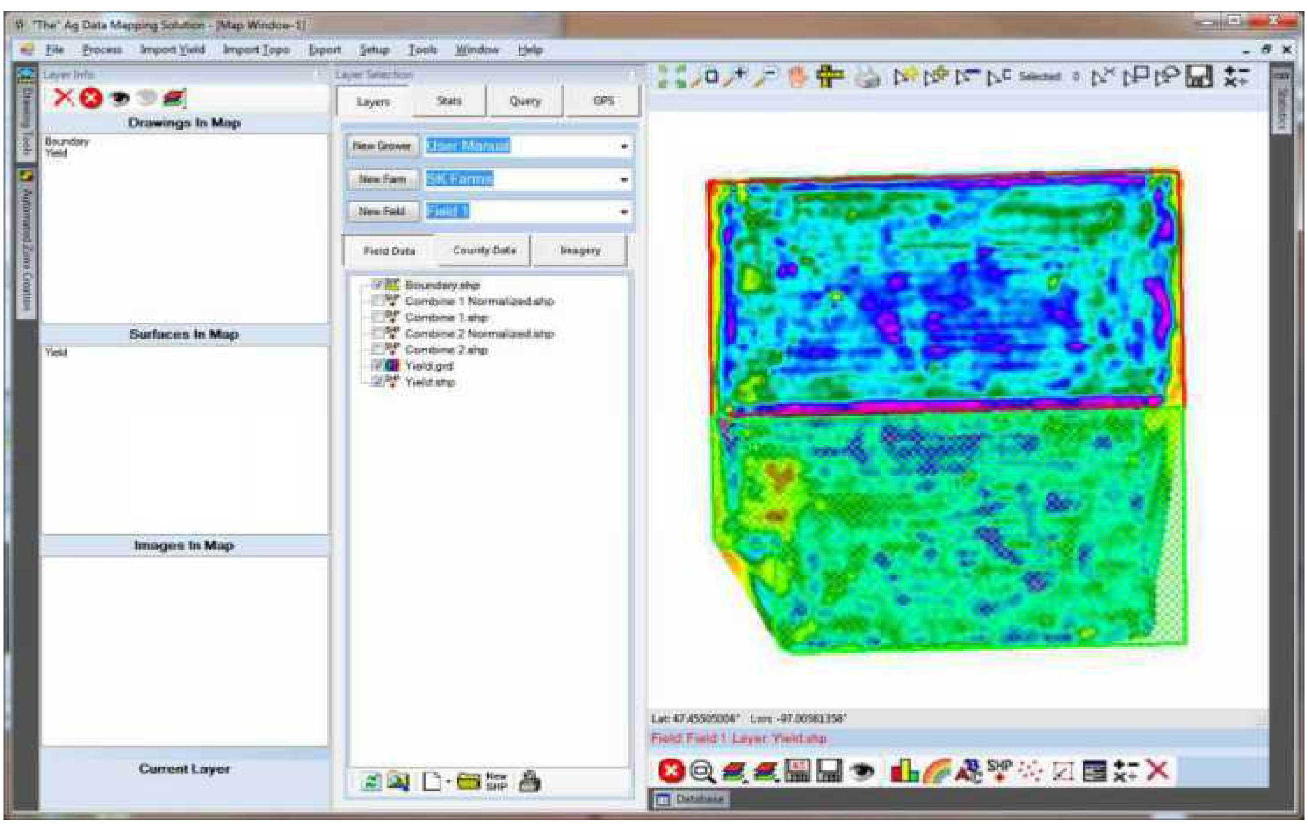
4. Click "Create Grid" button
    At this point you can "Un-Check" the Yield.shp

5 . Turn on the "Boundary.shp" - Left Click in map to "Select" it

6. Click on the "Yield.grd" file name to make it the active layer

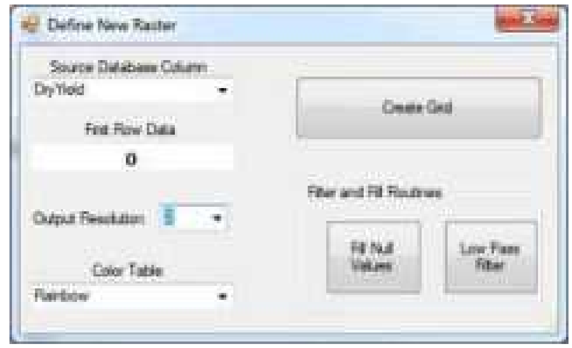
7. On the bottom toolbar click "Crop Raster to Selected Polygon"

8. Save the "Yield.grd" file
    This file is now ready to be used for Management Zones or Scripting



Scripting—2 Layer Merged Yield—Holes

For this script, you will need a Yield.grd and a "Complete Field.grd" = any xxx.grd that covers the whole field as you want it.



If you don't have a "Complete Field.grd", you will need to create or have a boundary.shp that will represent this.

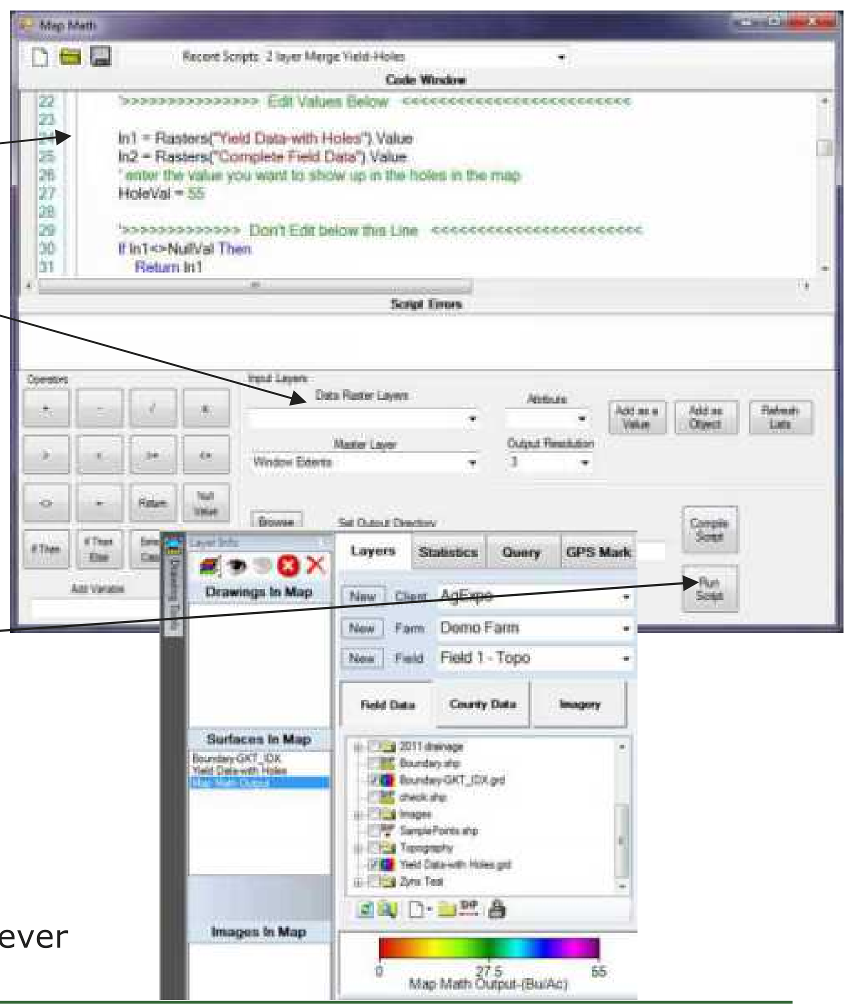
Right Click on the Boundary.shp "Create Grid" and "Create Grid from Polygons"

Do settings like Picture to Right. > "Create Grid"

Turn both "Yield.grd" and "CompleteField.grd" (may be Boundary.grd)

Click on the "Multi-Layer Map Math" on the top toolbar.

Open "2 Layer Merge Yield-Hole" Script



Line 24—Highlight or delete everything after "In1 ="

Select "Yield" under "Data Raster Layers" and Click "Add as Value"

Line 25—Repeat previous 2 steps assigning the "CompleteField.grd"

Line 27—Assign value for the Holes

Click "Compile Script"

"Run Script"

Click back to "Map Window" & "Layer Info"

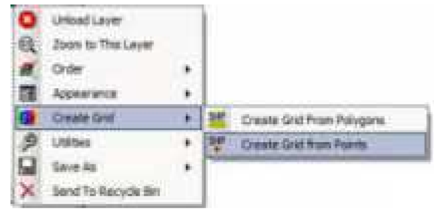
Click on "Map Math Output"

"Save As" - Yield Merged.grd or whatever name fits.

Processing Yield Data—Net Profit Map

1. Turn on the **"2007 Soybean Yield.csv"** in ADMS.

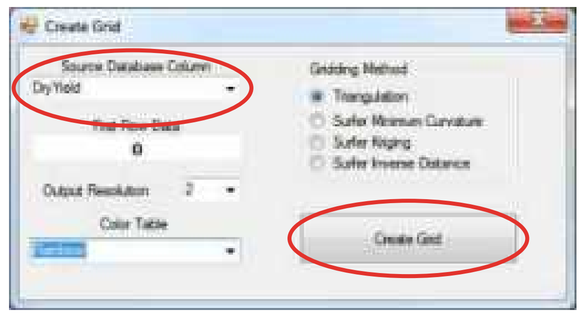
2. Right click on and it and click Save As ->SHP File and save it as **2007 Soybean Yield.shp**.



3. Turn on the **"2007 Soybean Yield.shp"**.

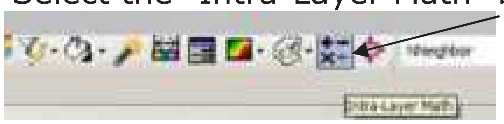
4. Right click and click Create Grid -> Create Grid from Points.

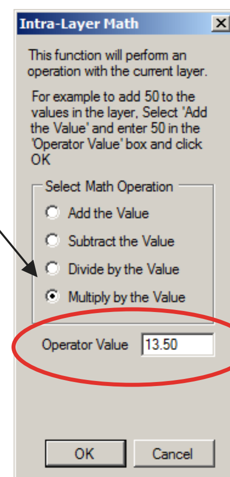
5. In the "Create Grid" popup window, select "Dry Yield" in the drop-down menu and click Create Grid.



6. Turn on the new **"2007 Soybean Yield.grd"**. (It should be the **Active Layer**).

7. Select the "Intra-Layer Math" button.





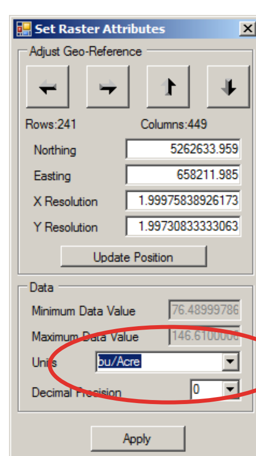
8. Click the "Multiply by the Value" radio button and enter the sale price of that crop/unit and click OK.

9. Now, make sure the **"2007 Soybean Yield.grd"** is still the **Active Layer**.

10. Select the "Intra-Layer Math" button again.

11. Click the "Subtract the Value" radio button and enter the input cost per acre, click OK.

12. Now click the "Surface Properties" button.



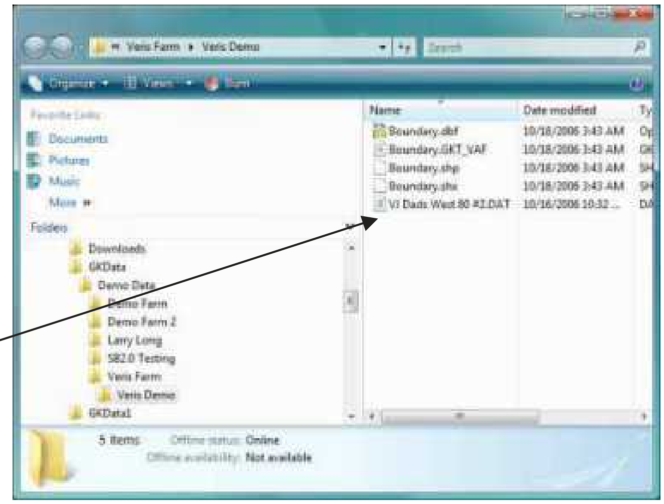
13. Select the proper Units for the crop and click Apply.

14. Click save on the bottom toolbar. You have now successfully turned a yield data map into a net profit map.

Processing Veris Data

Importing Veris DAT Files

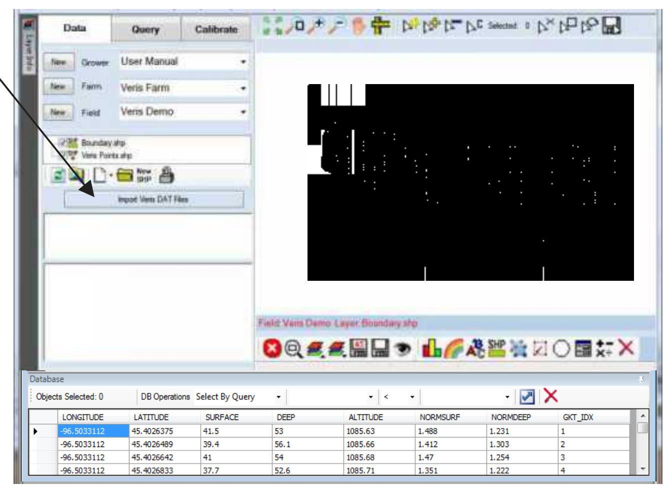
In this section, you will be importing Veris DAT Files for a field and combining them into a single SHP file for surfacing.



1. Start Ag Data Mapping Solution and go to the top tool bar, select the **"Process"** item, then **"Veris Data".**

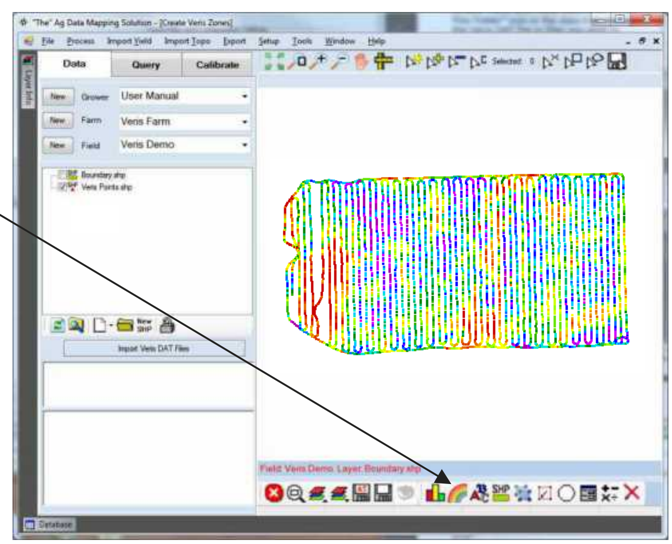
2. Select the Correct "Grower", "Farm" and "Field" for the data you are importing.

3. After selecting, or creating, the proper Grower Farm and Field, click the "Explore This Folder" icon in the data tree. Paste in the Veris DAT file or files you wish to process. You may also want to add a Boundary file if you have one.



4. Click the "Import Veris DAT Files" button. Choose one or multiple DAT files to import. If you choose multiple DAT files, all files will be merged into one "Veris Points" shapefile.
   As the data is imported, bad data such as negative values are filtered out of the data.

5. Columns named 'NormSurf' and 'NormDeep' are added to the data. These values are the normalized values for the surface and deep data layers.



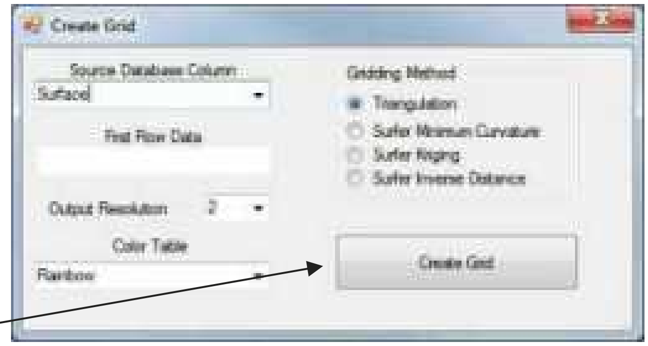
6. From there, you can use the 'Thematic Draw Settings' to set the color for the points. This is just for appearance. The data created for creating zones will be in surfaces which we will describe on the next page.

Processing Veris Data

Surfacing Veris DAT—SHP Files

In this section, you will be creating surfaces from shapefiles, and combining surfaces to create a single map for defining zones.

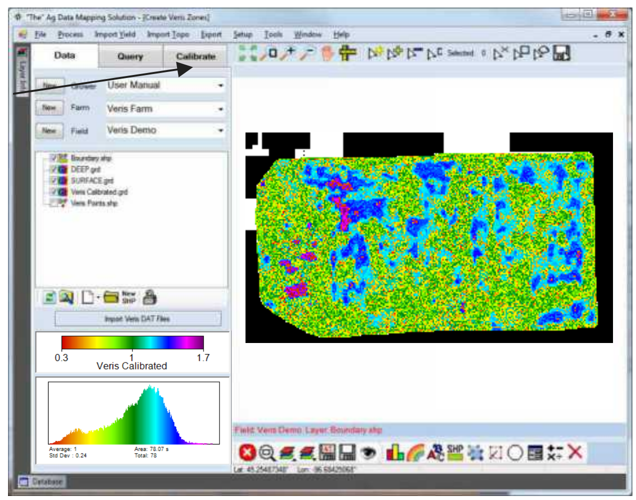
7. Right click on the Veris Points shapefile in the data tree. Choose “Create Grid”- “Create Grid from Points”. The dialog to the right will appear.



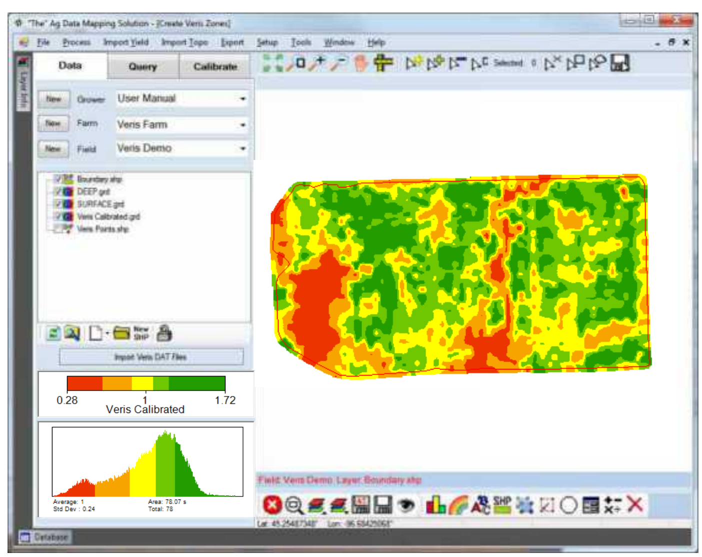
8. Under “Source Database Column” select the “**Surface**” item. Then click “Create Grid”.

9. Once that process completes, change the “Source Database Column” to “**Deep**” and Click “Create Grid” again.

10. Then switch to the “Calibrate” tab. Select the surface and Deep layers in the dialog boxes. Choose the weighting value for how much you would like each layer to influence the new output layer. By default the values are set at 60% Surface, 40% Deep. Click “Run Veris Calibration”.



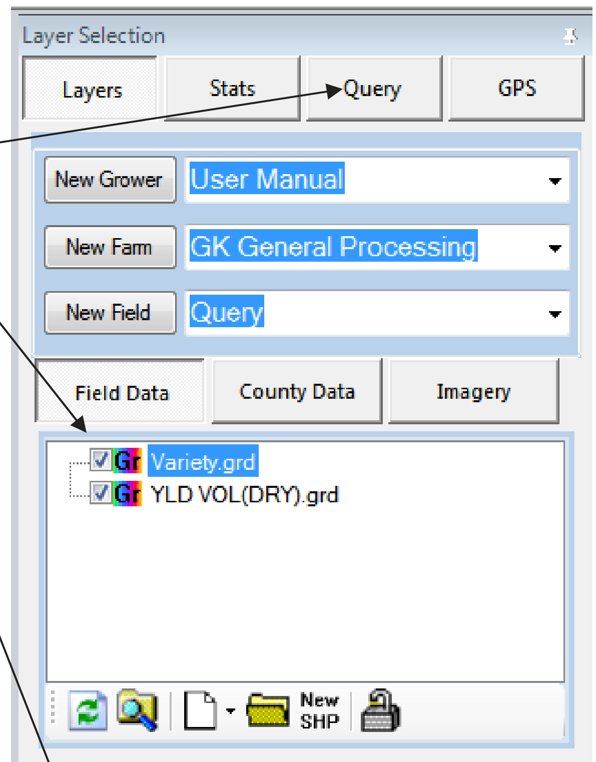
11. Set the zones using the Thematic Color tool. A good choice is a 5 zone using K-Means.



Query Tools

In **Query Tools,** we can select specific areas of a field surface and intersect or analyze that area with another surface. Examples of uses for the **Query Tool** are: select a Variety or Hybrid in field and intersect with yield, or select a specific range of Veris data and intersect it with a grid soil test to find a relationship between them. Query tools are only limited to your imagination and surfaces you have created.

We start by opening a **"Map Window"**  and selecting the desired Client, Farm and Field.

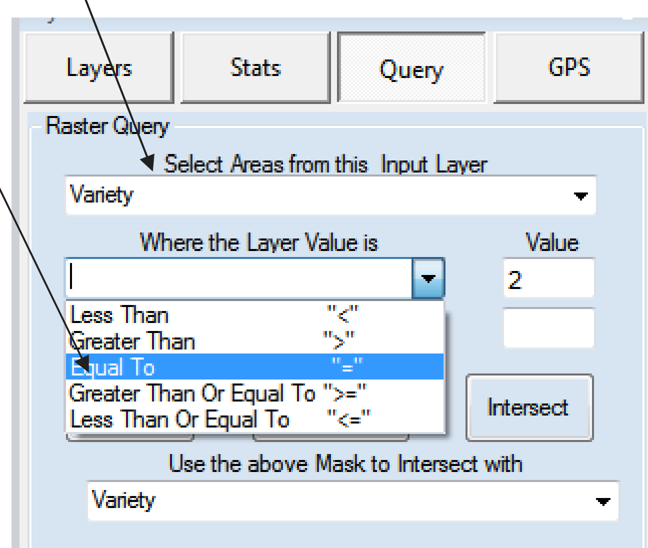


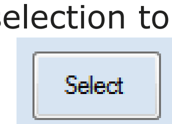
Turn on the surfaces you are interested in analyzing. You need to have at least two, but you can turn on as many as you would like.

Next, select the **"Query"** tab.

Under the "**Select Areas from the Input Layer"** drop down menu, select the layer you want to mask.

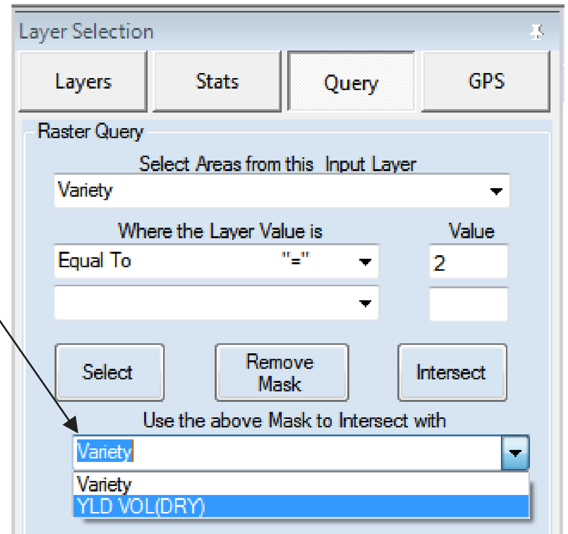
Next, select the area of the layer you want to analyze. If it is a variety layer where you have a specific number of values, use the "**Equal To ="** selection. If you are selecting a range of values (i.e. lbs of Fertilizer applied), use the **"Greater Than >" "Less Than >"** selections.



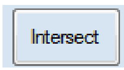
When finished with the selection to be masked, press the button. 

Query Tools

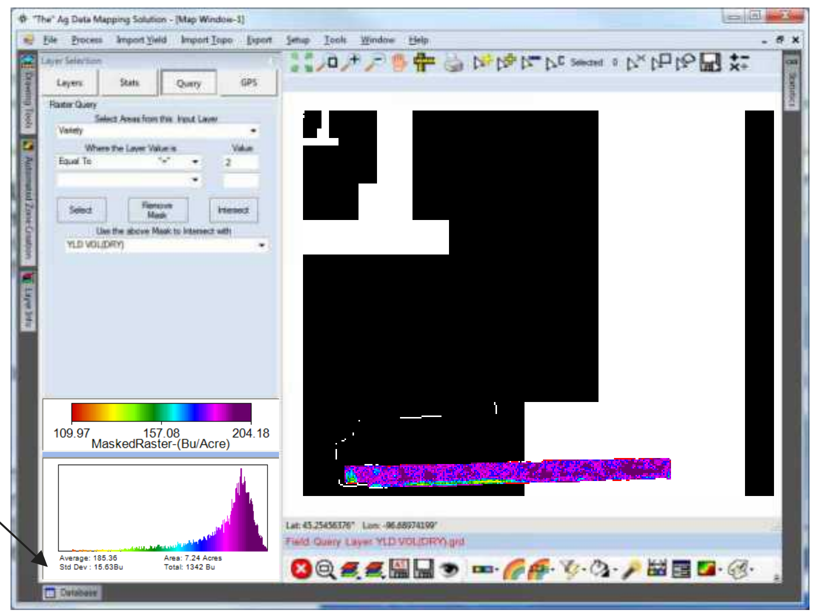
Under the **"Use the above Mask to Intersect with"** drop down menu, select the desired layer to intersect with the previous masked layer.



Once selected, press the button.



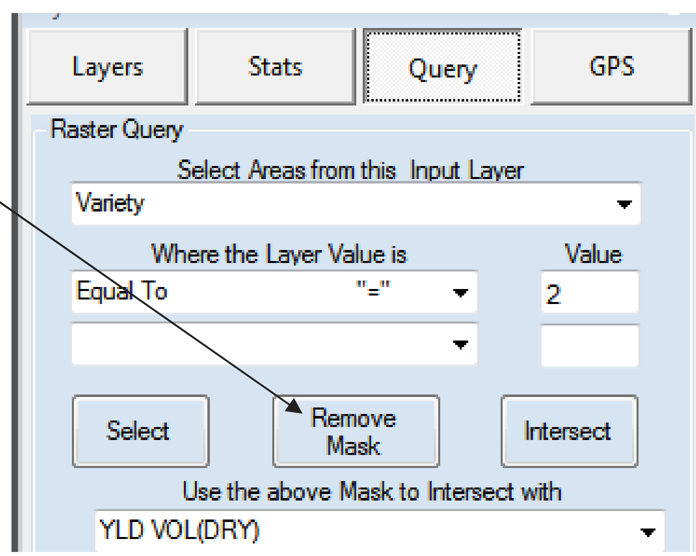
The map window shows what area has been masked (in this case, variety 2), and is intersected with the next selected layer (Yld Vol Dr).



The statistics windows show the range of the intersected layer in the masked area.

Below the histogram is the **Area** of the masked layer, also, the **Average, Total,** and the **Standard Deviation** of the intersected layer in the masked layer. In this example, it is labeled in Bu/Acre.

Once finished, click **"Remove Mask".** If you do not remove the mask, you will not be able to view any other maps or objects.



Summarize Another Layer

As you work with multiple layers of data you may want to get a Summary of how those layers interact. ADMS has a function call "Summarize to Another Layer". This tool allows you to pull data from your Grid or Zone from your Yield or from your Soil Test Results. Many combinations of things you can pull together here.

These examples will start at the point that you have done Grid/Zones, Created Rx Maps and have Yield data back.

Summarize—Grids (First Product)

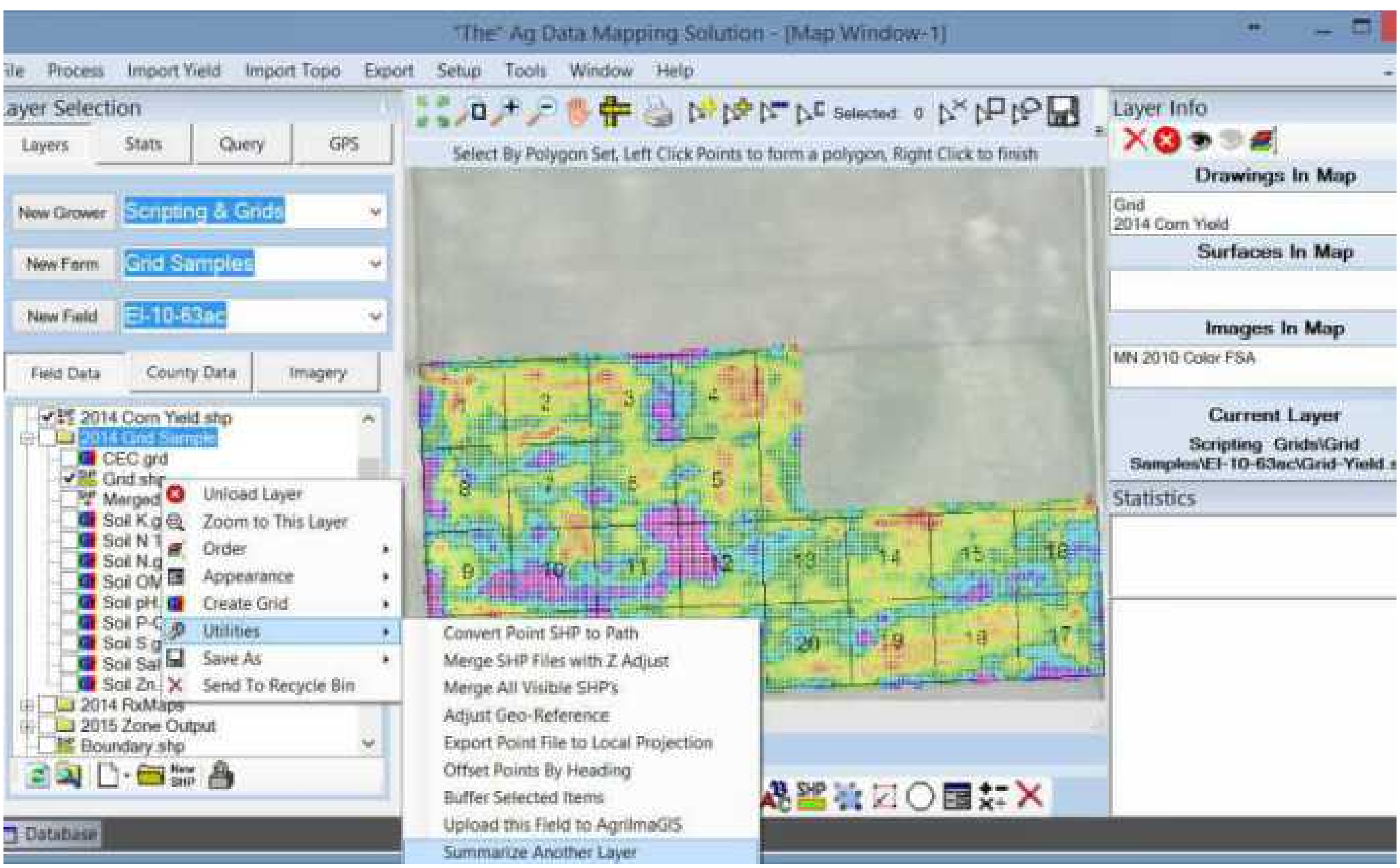
In this example we will run Grid Sample Results against Yield Data and 11-52-0. Each "summarized" product must be done as separate runs of this process.

NOTES: Suggest only turning on the "Drawing Layers" and "Surface Layers" you are working on. This will make things go smoother and cause less confusion.

Turn on your Grid (Polygons) and your Yield.shp for the first run (you could also use Yield.grd files also).

"Right Click" on the "Grid.shp"

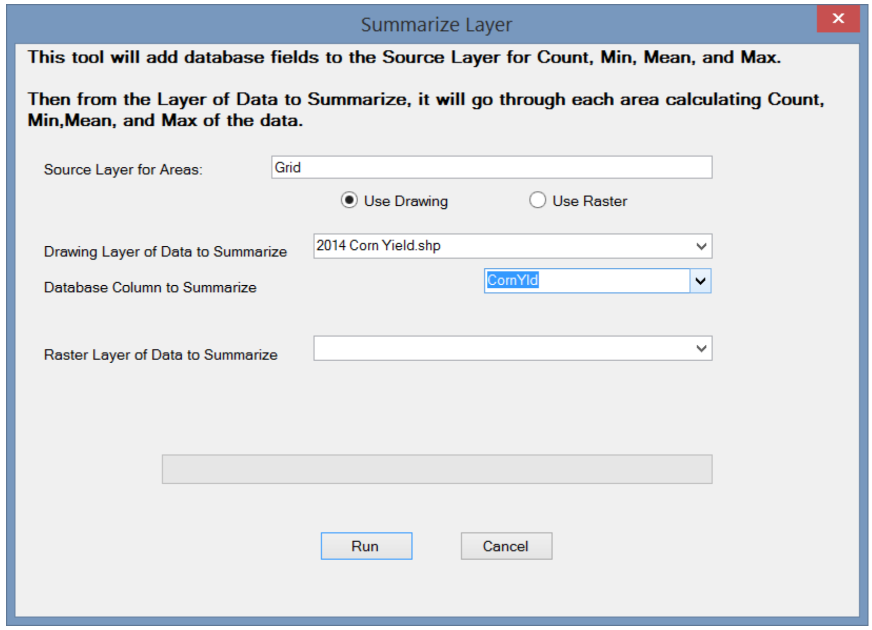
- Utilities
    - Summarize Another Layer



Summarize Another Layer

This will open the Summarize Layer window.

Since we are using a Yield.shp we need to choose "Use Drawing"



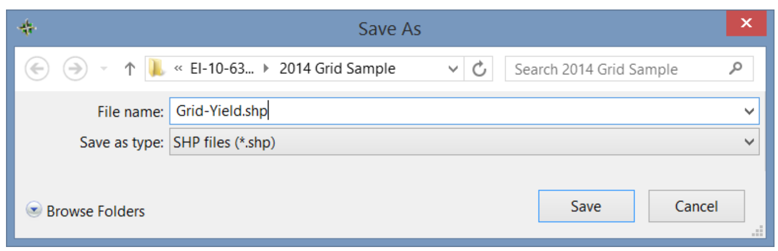
- Go down to the "Drawing Layer of Data to Summarize" and choose the "2014 Corn Yield.shp"
- Choose the "Database Column to Summarize" in this example it is "CornYld"
- Click "Run"

Once done running. Make sure your active layer is "Grid.shp" (layer that was the source of the summary).

Click "Save As"

RENAME to something different.

Ex– Grid-Yield.shp



The newly created .shp file has 4 new columns in it. A column for RecordCount / Min / Avg / Max of the 2014 Corn Yield for each Sample Grid.

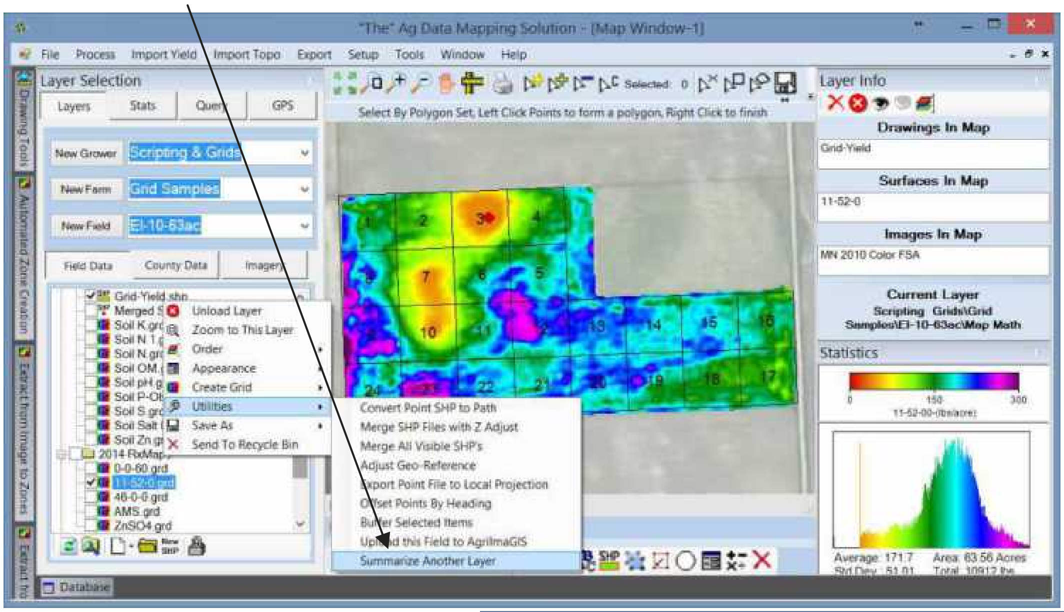
Summarize Another Layer

Summarize—Grids (Second Product)

Summary of our First product—"2014 Corn Yield.shp" is done, now doing 11-52-0.grd

Turn on your Grid-Yield (Polygons) and your 11-52-0.grd for the second run.

"Right Click" on the "Grid-Yield.shp"
- Utilities
  - Summarize Another Layer



This will open "Summarize Layer" Window

Choose "Use Raster"

Under "Raster Layer of Data to Summarize" choose "11-52-0.grd" for this example

Click Run

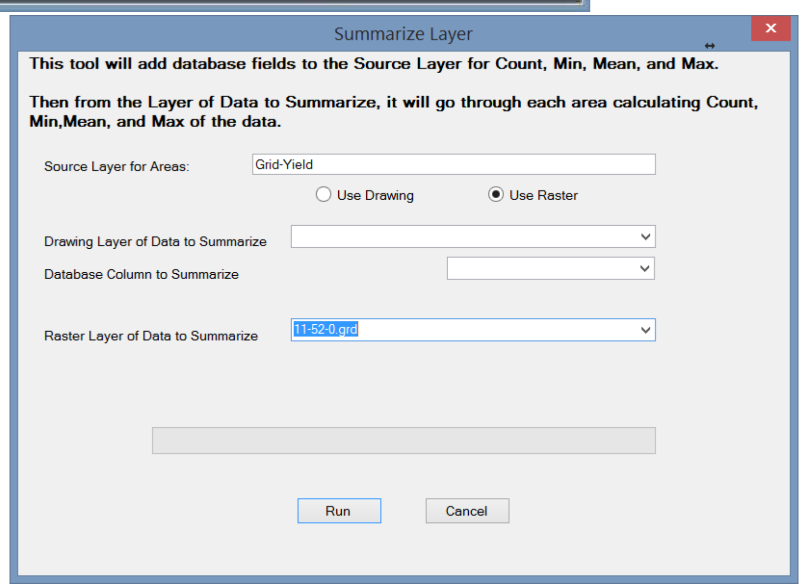
Make sure the Grid-Yield.shp is the active layer

Click "Save As"

Re-Name to something different

Ex-Grid-Yield-11-52-0.shp

NOTE-the .dbf file can be opened into Excel



PointID	GKT_IDX	GKT_Length	GKT_Area	2014 CoCNT	2014 CoMIN	2014 CoAVG	2014 CoMAX	11-52-0CNT	11-52-0MIN	11-52-0AVG	11-52-0MAX
1	21	1322.69	2.51	402	100.9	152.25946	222.4	1063	124.1438	167.7749	236.5499
2	22	1322.68	2.51	402	100.4	141.945267	182.7	1128	71.7697754	117.812057	169.502457
3	23	1322.69	2.51	405	100.8	162.711609	225.8	1094	40	63.5545654	158.121368

Getting Started With Map Math

This section begins a topic that seems to strike fear in the hearts of nearly every ADMS user. While it does expose you to new concepts, the use of scripting to create new layers is the most powerful feature of this package. Once you have an understanding of how to use this tool, there is almost nothing you can't do.

There are several topics that need to be covered for you to get an understanding of what Map Math does and how to use it.

- How to Declare and use variables.
- An explanation of the Map Layers, and the numbers behind them.
- An introduction to Object Based programming.
- An introduction to Visual Basic functions, enumerations, variables and a topic known as control flow functions.
- There are only about 5 different Visual Basic functions that are useful in Map Math.
    - The If Then, Else, End If statement.
    - The Select Case, Case, Case Else, End Select statement.
    - The Enum, End Enum Statement.
    - The System.Math functions.
    - Creating and using you own Functions.

The code that you write will be used to go through every pixel in the map, using values from other maps, to create an output map.

There are several internal functions that will give you access to data from the maps that you have loaded.

Also map layers can be accessed as an object to use other features that describe the map layers.

Now that we've defined what we need to know let's dive in! Come on in the water is fine. And no matter what you might think now, no one has ever drowned learning to write code. :-)

What Is A Null Value?

If there is one point that trips up many scripts, it is the concept of a null value, or NullVal, which is how it is referred to as a script.

Simply put a data raster layer in a square, and if the raster layer has been trimmed to a field boundary, the cells that are not in the area of the raster that is inside the field boundary are set to a unique number known as a Null Value.

This number is the largest number that can be stored in a single (1.70141E+38) cell. In a script, you can test to see if the value of a certain cell is null by this test:

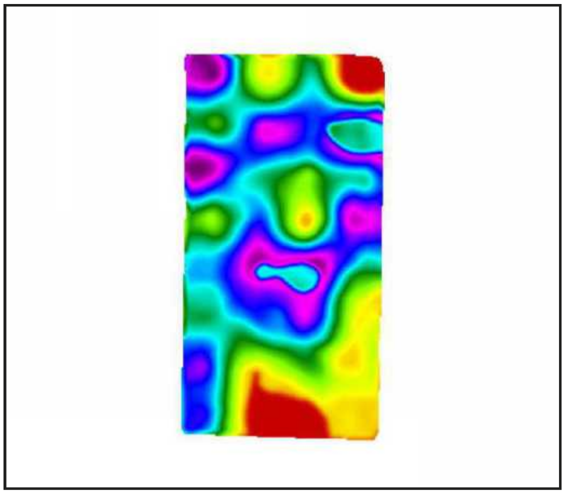
```
If A=NullVal then
    'The Input is Null Output a Null
    Return NullVal
Else
    'It isn't null so do the math
End If
```

In Ag Data Mapping Solution Version 3333 and later, there is also a check you can run that will test all layers, and if any are null, it will tell you.

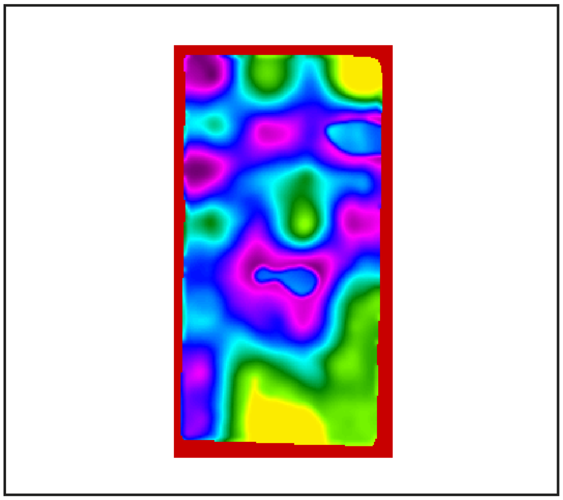
```
If InField=True then
    'All layers have data
Else
    'One or More Layers are Null
End If
```

To make the image on the lower right, this script was used.

```
If Infield Then
    Return Rasters("0-0-60").Value
Else
    Return 0
End If
```



A Normal Raster Layer Trimmed to Boundary



A Raster Layer with Null Values set to Zero (Red)

Side Note:

The "InField" call is a function in the script.

```
Public Shared Function InField() As
Boolean
    Dim InF As Boolean = True
    For Each R As Raster In Rasters
        If R.Value = NullVal Then
            InF = False
            Return InF
        End If
    Next R
    Return InF
End Function
```

Declaring and Using Variables

When we write code, one of the most important features is a 'variable'. A variable is a name for an object that you are using in your script. A variable can contain a number, a group of letters, or a complex object that contains a whole map layer.

For Map Math the Variables you may want to use are:

- A variable that stores a number without decimal points known as an 'Integer'.

  Declaring an integer like this, tells the program that you are going to use an integer named 'A'

  Dim A as Integer

  Declaring an integer like this, tells the program that you are going to use an integer named 'A' and sets its value = 10

  Dim A as Integer=10

- A variable that stores a number with decimal points known as a 'Single'.

  Dim A as Single
  Dim A as Single=0.46

  Declaring like this creates a variable that stores a value from a map at a certain location.

  Dim A as Single=Rasters("Yield Goal").Value

- A variable that allows you to access a map layer, known as a 'Raster'.

  Dim A as Raster

  Declaring like this creates a variable that stores a reference to a layer. This is an object and allows you to access the Minimum, Maximum, Average, and the value at a location.

  Dim A as Raster=Rasters("Yield Goal")

  To access the various values you would use a period after the variable name.

  A.Min, A.Max, A.Mean, A.StandardDev, and A.Value would all return numbers.

- A variable that stores a letter or a series of letters known as a 'String'.

  Dim A as String
  Dim A as String="Wheat Yield"

- A variable that stores True or False information known as a 'Boolean'.

  Dim A as Boolean
  Dim A as Boolean=False

Introduction to Functions

A function is a segment of code that takes input data as arguments, performs a specific "function" and returns a result.

In the example below, the portions of the function are defined. The function name is made by the person writing the function. Other than a few reserved key words that are used in Visual Basic, you can name the function whatever you like.

For the arguments, you can use as many different variables as you like. You should define what type of data the argument is (single, integer, string etc.)
For the return type, you should provide what type of data the number coming back will be (Single, Integer, Boolean).

Then write in the code you want to calculate your function, and finally use the 'Return' to return the value back to the code that called the function.

Function Name   Arguments   Return Type

```
Function myFunction( j As Integer) As Double
    myFunction = 3.87 * j
    Return myFunction
End Function
```

Process

Return

Introduction to Objects, Enumerations, and Collections

One of the most powerful tools in programming is the ability to create objects. We will start this section by creating a Vehicle Object. We will use properties of that object to describe different properties of a vehicle.

We will use Enumerations to provide input to the you about valid choices. So if we want to describe the type of engine in the vehicle, we create an Enumeration with valid choices:

```
Private Enum FuelType as Integer
    Gasoline=0
    Diesel=1
    Propane=2
End Enum
```

Now we can define an object to define the properties of the Vehicle and Functions that will return a calculated fuel required for a trip:

```
Private Class Vehicle
    Public VIN as String
    Public VehicleName as String
    Public NumberOfWheels as Integer
    Public FuelToUse as FuelType
    Public EngineSize as Single
    Public NeedsLicense as Boolean
    Public MilesPerGallon as Single

    Public Function HowMuchFuelDoINeed(MilesToTravel as Integer) as Single
        If MilesPerGallon <> 0 Then
            Return (MilesToTravel / MilesPerGallon) * 1.1
        Else
            Return 0
        End If
    End Function
End Class
```

To Use our new object:

```
Dim Veh As New Vehicle
Dim FuelNeeded As Single
Veh.VIN = "1Z4562538"
Veh.FuelToUse = FuelType.Diesel
Veh.EngineSize = 6.9
Veh.MilesPerGallon = 19
Veh.NeedsLicense = True
FuelNeeded = Veh.HowMuchFuelDoINeed(100)
```

Hundreds of objects could be filled out and added to a Collection of Vehicles that could describe anything from forklifts to tractors to semi-trucks to cars.

```
Dim VC as New Collection
VC.Add(Veh)
```

We don’t see you needing to create collections, but you will be accessing one collection so we showed one.

Raster Object and the Raster Collection

So, now that you are an expert with objects after going through the vehicle example, how are objects and enumerations used for scripting within Ag Data Mapping Solution?

Below is a class called Raster:

```
Public Class Raster
    Public Name As String
    Public ShortName As String
    Public Value As Single
    Public Min As Single
    Public Max As Single
    Public Mean As Single
    Public StandardDev As Single
End Class
```

When the map math window opens, it adds a “Raster” object for each raster layer that is open in the map window. It adds those Raster objects to a collection called “Rasters”.

Let’s say that you have a layer loaded with a short name of “2005 Corn Yield”. When you want to access that layer as an object, you can use the tools on the Map Math form to add it, but this is what is accomplished.

```
Dim YG As Raster
YG = Rasters("2005 Corn Yield")
        Or
Dim YG As Raster = Rasters("2005 Corn Yield")
```

Now that you have a variable called “YG”, you can access the properties of that Raster in your script. If you wanted to use a normalized yield goal:

Normalized Yield=Yield at a Point Divided By Average Yield for the Field

The code would look like this :

```
If InField Then
    Dim NormYield as Single
    NormYield=YG.Value/YG.Mean
    Return NormYield
Else
    Return NullVal
End If
```

Example: Minnesota P and K Recommendations for Corn

Table 8. Phosphate suggestions for corn production in Minnesota.*

Expected Yield		Soil test P (ppm)									
		v. low		low		medium		high		v. high	
	Bray:	0-5		6-10		11-15		16-20		21+	
	Olsen:	0-3		4-7		8-11		12-15		16+	
		Bdcst	Band	Bdcst	Band	Bdcst	Band	Bdcst	Band	Bdcst	Band
bu/acre		--------------------- P_2O_5 /acre to apply (lb/acre) --------------------									
< 100		60	30	40	20	25	20	10	10-15	0	10-15
100 – 124		75	40	50	25	30	20	10	10-15	0	10-15
125 – 149		85	45	60	30	35	25	10	10-15	0	10-15
150 – 174		100	50	70	35	40	30	15	10-15	0	10-15
175 – 199		110	55	75	40	45	30	15	10-15	0	10-15
200 +		120	60	85	45	50	35	15	10-15	0	10-15

* *Use one of the following equations if a P_2O_5 recommendation for a specific soil test value and a specific e*

P_2O_{5Rec} = [0.700 - (.035 (Bray P ppm)] (expected yield)

P_2O_{5Rec} = [0.700 - (.044 (Olsen P ppm)] (expected yield)

No phosphate fertilizer is recommended if the soil test for P is higher than 25 ppm (Bray) or 20 ppm (Olsen).

Table 9. Potash suggestions for corn production in Minnesota.*

Expected Yield	Soil test K (ppm)									
	v. low		low		medium		high		v. high	
	0-40		41-80		81-120		121-160		160+	
	Bdcst	Band	Bdcst	Band	Bdcst	Band	Bdcst	Band	Bdcst	Band
bu/acre	------------------ K_2O/acre to apply (lb/acre) ------------------									
< 100	100	50	75	40	45	30	15	10-15	0	10-15
100 – 124	120	60	90	45	50	30	20	10-15	0	10-15
125 - 149	145	75	105	55	60	40	20	10-15	0	10-15
150 - 174	165	85	120	60	70	40	25	10-15	0	10-15
175 - 199	185	90	135	70	80	50	25	10-15	0	10-15
200 +	205	105	160	80	90	55	30	10-15	0	10-15

* *Use one of the following equations if a K_2O recommendation for a specific soil test value and a specific expected yield is desired.*

K_2O_{Rec} = [1.166 - .0073 (Soil Test K, ppm)] (expected yield)

No potash fertilizer is recommended if the soil test for K is 175 ppm or higher.

Above are the tables from the University of Minnesota with their recommended rates for fertilizing corn. We will work our way through the process of converting this to a script for creating a fertilizer map from a P and K soil test value map, and a yield goal map.

Below the tables, you can see formulas that allow us to calculate P and K fertilizer rates for a specific yield goal and soil test value.

While these scripts calculate nutrient lbs, they aren’t quite done. They need to have some traps for error conditions, and they also need to convert the nutrient pounds to product pounds.

P_2O_{5Rec} = [0.700 - (.044 x (Olsen P ppm)] x (expected yield)

```
Dim P2O5 As Single
Dim OLSENPST As Single = Rasters("P_OLSEN").Value
Dim EXPYIELD As Single = Rasters("2005 Corn Yield").Value

If Infield Then

        ‘Check to See if it is Less Than 20 ppm
        If OLSENPST < 20 Then
                P2O5 = (0.7 - (.044 * OLSENPST)) * EXPYIELD
        Else
                ‘It was over 20 ppm so apply 0
                P2O5 = 0
        End If

        ‘Send the Value to the Map
        Return P2O5

Else
        ‘Wasn’t In the Field Send a NullVal to the Map
```

K_2O_{Rec} = [1.166 - .0073 x (Soil Test K, ppm)] x (expected yield)

```
Dim K2O as Single
Dim KST As Single = Rasters("K_UNSPEC").Value
Dim EXPYIELD As Single = Rasters("2005 Corn Yield").Value

If Infield Then
        ‘Check to See if it is Less Than 175 ppm
        If KST < 175 Then
                K2O = (1.166 - (.0073 * KST)) * EXPYIELD
        Else
                ‘It was over 175 ppm so apply 0
                K2O = 0
        End If

        ‘Send the Value to the Map
        Return K2O

Else
        ‘Wasn’t In the Field Send a NullVal to the Map
```

They could easily be modified to handle that chore, but along with combining the scripts, we will do that in a more robust fashion in the next pages. Later, we will build a Product object to help with those calculations.

Opening a Script Editor in Excel 2007

One really neat way to debug and develop functions for use in Map Math is to use Excel to develop that code. There are features like the ability to insert breakpoints and develop tests for viewing how a script works.

In Excel 2007, here is how to set up the scripting process.

1. Start with a blank “Book1” then click the ‘Start Button’.

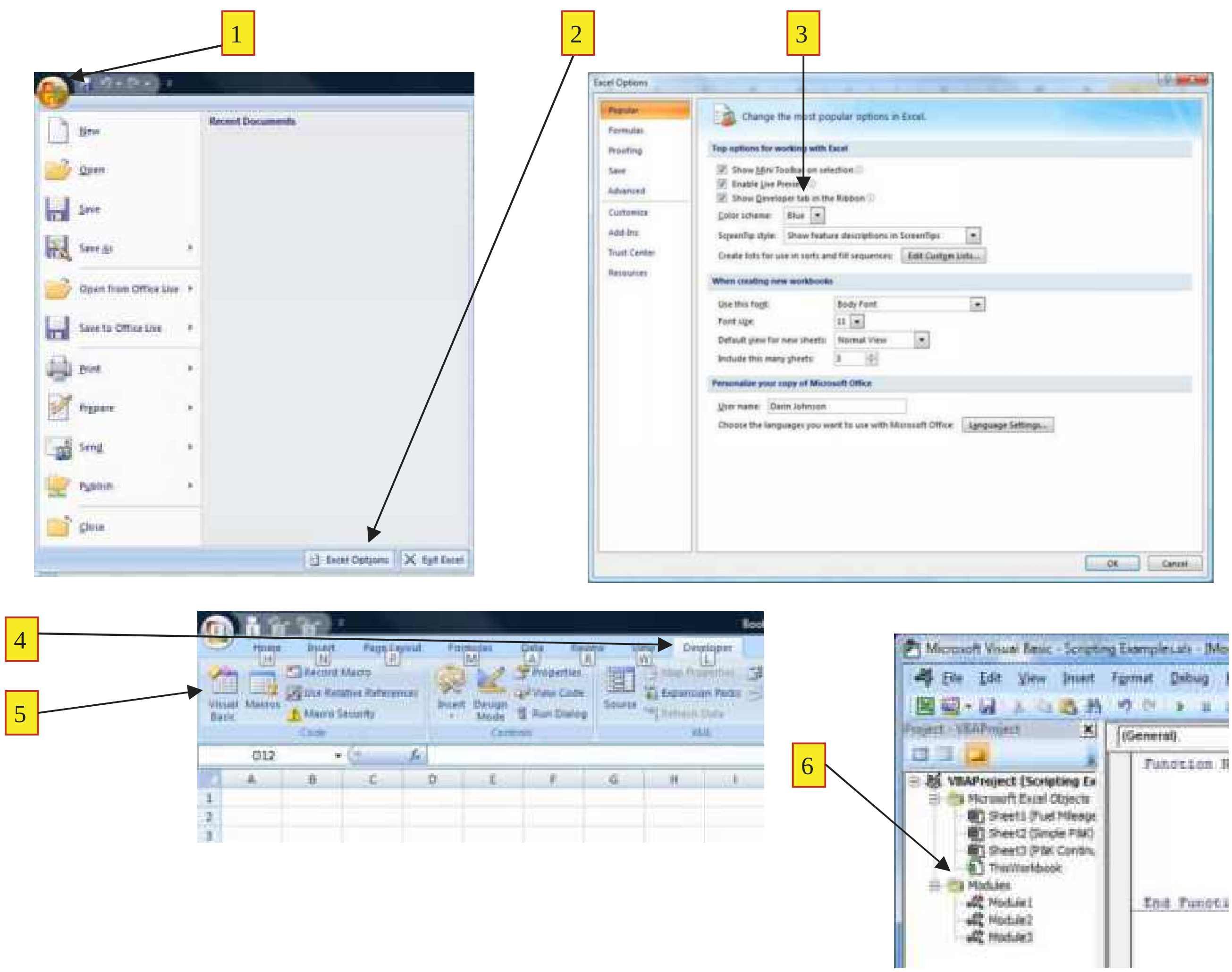
2. Click ‘Excel Options’.

3. In the window that opens, click then ‘Show Developer tab in the Ribbon’.

4. Click the ‘Developer’ tab.

5. Click ’Visual Basic’.

6. Right click on ‘Modules’ and Insert a Module.



Opening a Script Editor in Excel 2003

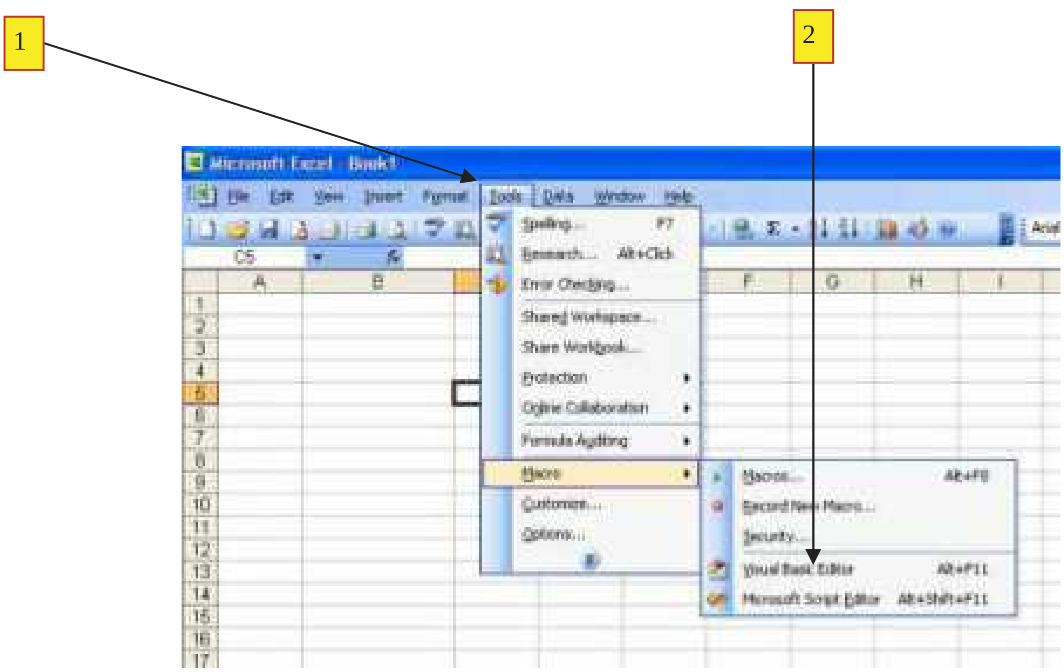
One really neat way to debug and develop functions for use in Map Math is to use Excel to develop that code. There are features like the ability to insert breakpoints and develop tests for viewing how a script works.

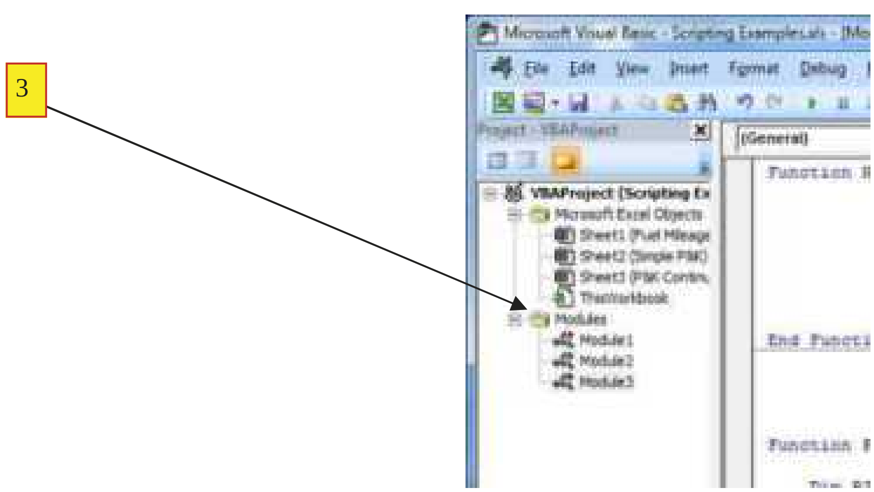
In Excel 2003, here is how to set up the scripting process.

1. Start with a blank "Book1" then click the 'Start Button'.

2. Click Tools-Visual Basic Editor.

3. Right click on 'Modules' and Insert a Module.





P & K continued—Introducing—Select Case

Using Select Case is a way of re-directing which path the script will use when it runs.

A simple example of using Select Case is shown below with the Infield function.

If you remember the InField function returns a TRUE if the current cell is in the field, and a FALSE if it isn't.

```
Select Case InField
        Case True
                'Do this if I am in the field

        Case False
                'Do this if I am not
End Select
```

An example to the right demonstrates using an Enumeration of the map to build in a Select Case statement.

In this case, it will determine which output map will be created.

It is a very powerful Tool that allows for compound tests like below. This example has nothing to do with Map Math but demonstrates a way to Divide by Ranges

```
Dim Number as Integer =8

Select Case Number
        Case 1 To 5
                Return 3
        Case 6 to 10
                Return 8
        Case 11 ,12
                Return 11
        Case 13 To 15
                Return 15
        Case Is > 20
                Return 20
        Case Else
                Return 15
End Select
```

```
Dim P2O5 As Single
Dim K2O As Single
Dim MakeMap As Output

Dim OlsenPST As Single = Rasters("P_OLSEN").Value
Dim ExpYield As Single = Rasters("2005 Corn Yield").Value
Dim KST As Single = Rasters("K_UNSPEC").Value

MakeMap = Output.P

If InField Then

        Select Case MakeMap
                Case Output.P

                'Check To See If it Is Less Than 20 ppm
                If OlsenPST < 20 Then
                        P2O5 = (0.7 - (.044 * OlsenPST)) *
ExpYield
                Else
                        P2O5 = 0
                End If

                'Send the Value to the Map
                Return P2O5

        Case Output.K

                'Check To See If it Is Less Than 175 ppm
                If KST < 175 Then
                        K2O = (1.166 - (.0073 * KST)) * ExpYield
                Else
                        'It was over 175 ppm so apply 0
                        K2O = 0
                End If

                'Send the Value to the Map
                Return K2O

        End Select

Else
        'Wasn't in the Map Return a Null Value
        Return NullVal
End If


'Outside of the Main Function these 3 lines need to be Added.
'This makes for the selection of P or K at the MakeMap varia-
ble.

Private Enum Output
        P
        K
End Enum
```

More Complex Functions

Wrap Up the P and K as Functions

Below we add some more necessary calculations, and wrap it into a Function.

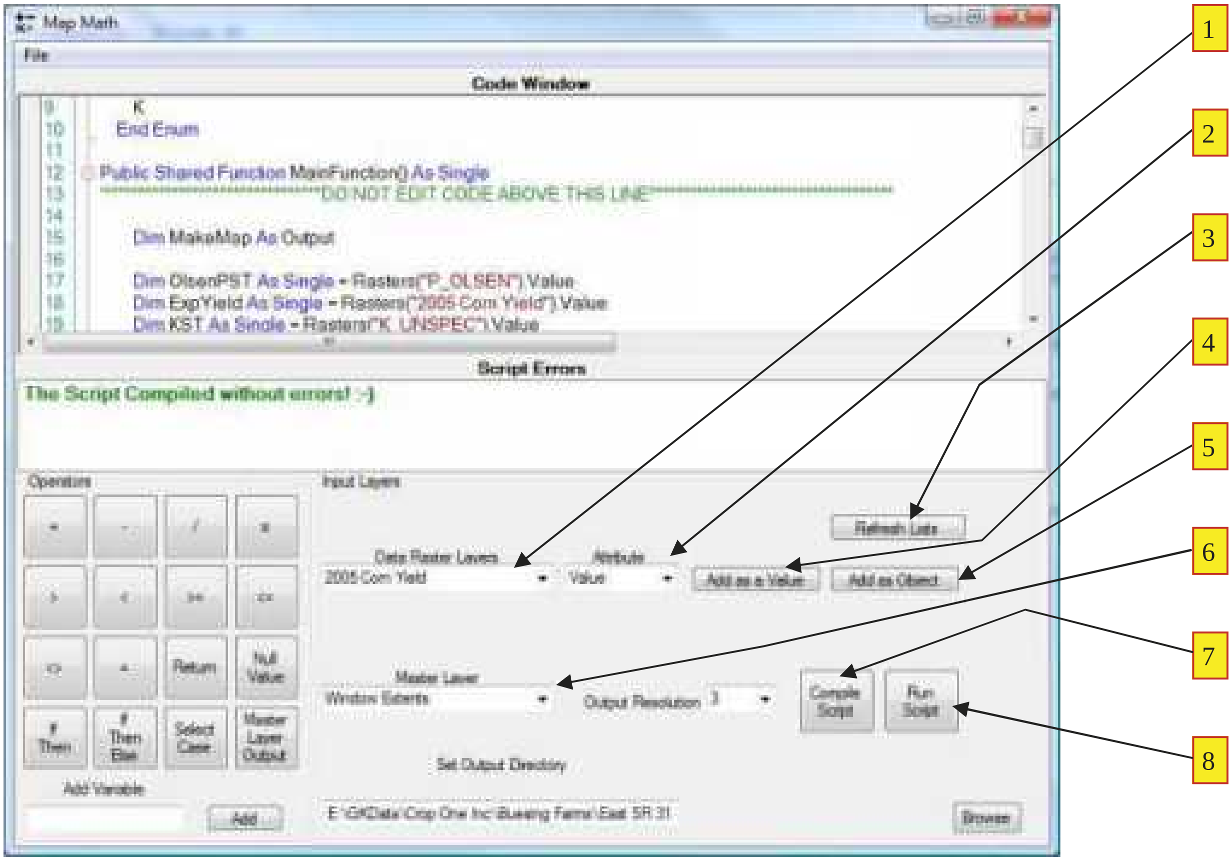
```
Private Shared Function CalcNitrogenNDSURec (EXPYIELD As Single, NitrogenSoilTest As Single, OLSENPST As Single, _
                                              MinimumApp As Single, MaximumApp As Single, NProductNConc As Single, _
                                              PProductNConc As Single, PProductPConc As Single, MinPApp As Single, _
                                              MaxPApp As Single) As Single
    Dim NFromP As Single
    Dim P2App As Single
    Dim NtoApply As Single

    P2App = CalcPhospateUofMRec (EXPYIELD, OLSENPST, MinPApp, MaxPApp, PProductNConc, PProductPConc, NFromP)

    NtoApply = (EXPYIELD * 1.2) - NitrogenSoilTest - NFromP
    CalcNitrogenNDSURec = NtoApply / NProductNConc

End Function


Private Shared Function CalcPhospateUofMRec (OlsenPST as Single, YieldGoal as Single, ProductPConc as Single, _
                                          ProductNConc as Single, ByRef NFromP as Single) as Single

        'The ByRef Keyword allows the function to Modify the NFromP value, in Effect Returning how
        'much N is coming along with the Phosphate Product

        Dim PProdPounds as Single
        'Check To See If it Is Less Than 20 ppm
        If OlsenPST < 20 Then
                P2O5 = (0.7 - (.044 * OlsenPST)) * YieldGoal
        Else
                P2O5 = 0
        End If

        If P2O5<0 Then P2O5=0

        'Calculate the Product Pounds
        PProdPounds=P2O5 / ProductPConc

        'Calculate how much N comes with the P
        NFromP=PProdPounds * ProductPConc

        'Send the Value to the Map
        Return PProdPounds

End Function

Private Shared Function CalcPotashUofMRec (KST as Single, YieldGoal as Single, ProductKConc as Single) as Single

        'Check To See If it Is Less Than 175 ppm
        If KST < 175 Then
                K2O = (1.166 - (.0073 * KST)) * YieldGoal
        Else
                'It was over 175 ppm so apply 0
                K2O = 0
        End If

        If K2O<0 then K20=0

        'Send the Value to the Map
        Return K2O/ProductKConc

End Function
```

Script Written Using Functions

The main purpose of using functions is to break code into smaller, bite size modules that allow you to better follow what is going on in the script. You can see below that it does simplify the code greatly.

```
Dim P2O5 As Single
Dim K2O As Single
Dim MakeMap As Output

Dim NitrogenSoilTest as Single=40
Dim ExpYield As Single = Rasters("2005 Corn Yield").Value
Dim OlsenPST As Single = Rasters("P_OLSEN").Value
Dim KST As Single = Rasters("K_UNSPEC").Value

MakeMap = Output.N

If InField Then
    Select Case MakeMap

        Case Output.N
            Return CalcNitrogenNDSURec (EXPYIELD, NitrogenSoilTest, OLSENPST,
                    MinimumApp, MaximumApp A, NProductNConc, PProductNConc ,
                    PProductPConc , MinPApp , MaxPApp )

        Case Output.P
            Return CalcPhospateUofMRec (OlsenPST, ExpYield, 0.52, 0.11, NFromP)

        Case Output.K
            Return CalcPotashUofMRec (KST, ExpYield, 0.6)

    End Select
Else
    Return NullVal
End If
```

Map Math Controls



1. A list of raster layers loaded in the map that can be used in the script.
2. An attribute for the layer, Min, Max, or Mean for that layer that can be accessed.
3. Click this button to add any new layers that have been turned on in the map since the Map Math window was opened.
4. Adds a string to the script that provides access to the value in a map layer.
5. Adds a string to the script that provides access to the layer as a Raster “Object”.
6. Selects how far the extents of the processing should go, the whole window or just a certain layer.
7. Compiles the script and displays errors and the line numbers of those errors.
8. Runs the script and creates a new raster layer called “Map Math Output”.

System.Math Functions

Name	Description
Abs	Overloaded. Returns the absolute value of a specified number.
Acos	Returns the angle whose cosine is the specified number.
Asin	Returns the angle whose sine is the specified number.
Atan	Returns the angle whose tangent is the specified number.
Atan2	Returns the angle whose tangent is the quotient of two specified numbers.
BigMul	Produces the full product of two 32-bit numbers.
Ceiling	Overloaded. Returns the smallest integer greater than or equal to the specified number.
Cos	Returns the cosine of the specified angle.
Cosh	Returns the hyperbolic cosine of the specified angle.
DivRem	Overloaded. Calculates the quotient of two numbers and also returns the remainder in an output parameter.
Exp	Returns **e** raised to the specified power.
Floor	Overloaded. Returns the largest integer less than or equal to the specified number.
IEEERemainder	Returns the remainder resulting from the division of a specified number by another specified number.
Log	Overloaded. Returns the logarithm of a specified number.
Log10	Returns the base 10 logarithm of a specified number.
Max	Overloaded. Returns the larger of two specified numbers.
Min	Overloaded. Returns the smaller of two numbers.
Pow	Returns a specified number raised to the specified power.
Round	Overloaded. Rounds a value to the nearest integer or specified number of decimal places.
Sign	Overloaded. Returns a value indicating the sign of a number.
Sin	Returns the sine of the specified angle.
Sinh	Returns the hyperbolic sine of the specified angle.
Sqrt	Returns the square root of a specified number.
Tan	Returns the tangent of the specified angle.
Tanh	Returns the hyperbolic tangent of the specified angle.
Truncate	Overloaded. Calculates the integral part of a number.

Scripting—Using GK Created Scripts

The instructions in "Using GK Created Scripts" will walk you through some of the most common scripts used in Ag Data Mapping Solution. There are MANY more script that can be used or created. The idea below will tell you a little about the script and what it does and what data you have to enter.

Reminders – Here are some "Scripting Terms" to remember as you are reading through the scripting instructions below.

Null Value = essentially areas in a surface that have "Pixels" with no "Data Value". This means it is not a 0 to 1,000,000,000 value, it is a NULL VALUE. See the scripting section on "What is a Null Value?" for further explanation.

If in Field = if there is a hole in one surface (no data in an area), then there is a hole in the output surface of that field. Because there is data missing in one map the math operation will NOT run on that area, returning a NULL VALUE (not zeros).

Upon creating your "MapMath" layers, we suggest "SAVE AS" and renaming your layer to represent your newly created map.

-Script Explanations-

2 Layer Add – Will Add 2 surfaces in the "Same Field", using "If in Field" logic.

- To assign different "UNITS" on line 7 (default –Units/Ac)
- Assign Input Surface names on lines 19 & 20 (Add as a Value)
- The "Math" is done on line 24
- Useful for checking total seed in Soybean "Offensive-Defensive Soybean" Seeding maps
- Creates a new Surface named "MapMath-2LayerAdd.grd"

2 Layer Difference – Will Subtract 2 surfaces in the "Same Field", using "If in Field" logic.

- To assign different "UNITS" on line 7 (default –Units/Ac)
- Assign Input Surface names on lines 19 & 20 (Add as a Value)
- The "Math" is done on line 24
- Useful for checking your "LIDAR vs RTK" Elevation maps
- Creates a new Surface named "MapMath-2LayerDiff.grd"

Scripting—Using GK Created Scripts

Apply Liner Values – Allows the user to enter an "AVERAGE" rate you would like applied on a field. Then assign a Low Rate % and a High Rate % indicating how much you want to go down & up from the Average rate. NOTE: Input layer should be a layer that represents "PRODUCTION or YIELD" of a field.

- Assign Input Surface name on line 14 (Add as Object)
- Line 15 = Average Rate to apply (example 120 lbs/acre wheat seed)
- Line 16 = Low Rate % (example 30 – create a low rate of 84 lbs/acre)
-Line 17 = High Rate % (example 20 – create a high rate of 144 lbs/acre)
--Example Note – VRT would go from 84 to 144 and the average would be "ROUGHLY" 120
The average is usually off a little, based on the math being done in a "linear" equation
and the spatial data is not.
- The "Math" is done on line 37-50 (do not edit)
- To assign different "UNITS" on line 60 (default –lbs/acre)
- Useful for creating fertility maps and seeding maps
** GK Technology Inc. recommends Zone Soil Testing and assigning rates to zones **
- Creates a new Surface named "MapMath-ApplyLinear.grd"

Average of All Layers – Will Normalize all the layers turned on, Add them together, takes a count of how many surfaces are turned on and return an Average Normalized Layer, using "If in Field" logic.

- To assign different "UNITS" on line 7 (default –Units/Ac)
- Runs Script on all Surfaces that are turned on!!
- The "Math" is done on line 20-25
- Useful for merging multiple years of data (Ex. Yield / Imagery / Topo / Veris)
- Creates a new Surface named "Avg All Layers.grd"

Average of All Layers-wHoles – Will Normalize all the layers turned on, Add them together, takes a count of how many surfaces are turned on and return an Average Normalized Layer, using "Null Value" logic. This means that the areas of maps that have "Holes" (missing data) will calculate their own values.

- To assign different "UNITS" on line 7 (default –Units/Ac)
- Runs Script on all Surfaces that are turned on!!
- The "Math" is done on line 22-30
- Useful for merging multiple years of data (Ex. Yield / Imagery / Topo / Veris)
- Creates a new Surface named "Avg All Layers-Holes.grd"

Scripting—Using GK Created Scripts

CornPop-max-min – Will give you a "Corn Seeding Rate" based of a Divisor & Yield Map. You must have a Yield Map or a Yield Goal map to use this script.

- Useful for creating Corn Seeding Maps
- Creates a new Surface named "MapMath-CornSeed.grd"
- Assign Input Surface name on line 16 (Add as a Value)
- Line 19 = Minimum Seed Rate
- Line 20 = Maximum Seed Rate
- Line 21 = Divisor value (X) (Example –(Yield Goal/ X) *1000 = Seeding Rate)
- Line 24 = Seeding Rate Increment (1000 will give seeding rates of 30,000 & 31,000 with no rates between)
- The "Math" is done on line 31-37

Merge All Visible – Uses the "null values" function. This script will return the value at each pixel on each map. If the maps overlap, it will return the value of the first map turned on.

- To assign different "UNITS" on line 7 (default –Units/Ac)
- Runs Script on all Surfaces that are turned on!!
- The "Math" is done on line 18-19
- Useful for merging data from multiple adjacent fields.
- Creates a new Surface named "Merged Layers.grd"

Merge All Visible-Normalized - Uses the "null values" function. The script will "Normalize" all the surfaces that are turned on and visible. This script will return the value at each pixel on each map. If the maps overlap, it will return the value of the first map turned on.

- To assign different "UNITS" on line 7 (default –Units/Ac)
- Runs Script on all Surfaces that are turned on!!
- The "Math" is done on line 18-19
- Useful for merging data from multiple adjacent fields.
- Creates a new Surface named "Merged Layer-Normalized.grd"

Min-Max Lbs-Ac - Uses the "null values" function. The script will take a "Prescription map.grd" and allow you to set the Max and Min rates you will use. So if you had a map that went from 0 - 330 lbs. of UREA with a rate at every pound 0,1,2,3……, and your "Spreader" could only spread 0 & 100-300 lbs. of Urea (rates from 1-99 cause erratic rates). You can set parameters to make rates to fit these controller limitations.

- To assign different "UNITS" on line 7 (default –Lbs/Ac)
- Assign Input Surface name on lines 19 (Add as a Value)
- Assign "ZeroBreak" on line 22 - any pixel value in the map lower than this will go to "0" & any value higher than this value, but lower than the "MinRate" will become the "MinRate" value.
- Assign "MinRate" on line 24 – aside from "0" this will be the lowest rate on the map.
- Assign "MaxRate" on line 26 – This is the max value that will be assigned in the map, any val ues higher than that value will become the "MaxRate" value.
- The "Math" is done on line 31-43
- Creates a new Surface named "Map Math Output.grd"

Scripting—Using GK Created Scripts

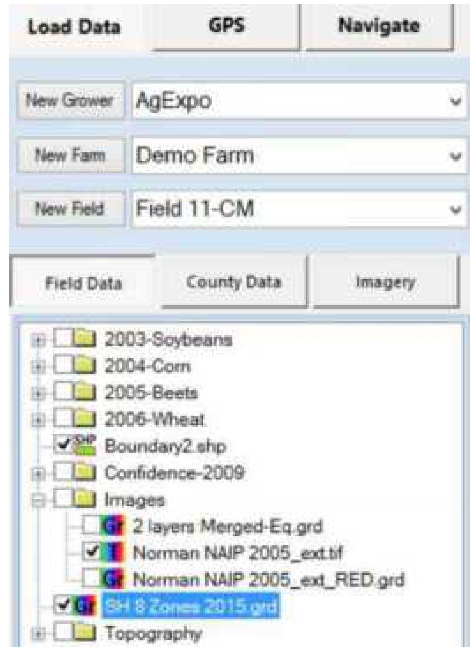
Net Revenue - Uses the "If in Field" function. The script will require Yield data, all your VRT seed and fertilizers for the field you are working on. You will also need to have values for the selling price per bushel, cost per ton of product (fertilizer), the cost per bag of seed and the Fixed cost for the farm (less the VRT porducts.

- Line 6 will create a new Surface named "Net Revenue.grd"
- To assign different "UNITS" on line 6 (default –Dollars/Acre)
- Assign Input Surface name on lines 18-24 (Add as a Value)
- Assign the values for commodity, fertilizer, seed and fixed cost on lines 27-41
- The "Math" is done on line 48
- Note: before closing this script, suggest saving these values and renaming to save time.
    - Example - Save & Rename "Net Revenue-corn-2012"

YieldMaxLayer – Uses the "If in Field" logic. Looks through all the layers turned on and finds the layer with the highest value at every pixel. This script is designed to work with yield data from the "Same Crop" on a given field.

- Creates a new Surface named "Yield Max Layer.grd" on line 25
- To assign different "UNITS" on line 26 (default –bu/ac)
- Runs Script on all Surfaces that are turned on!!
- The "Math" is done on line 14-16
- Useful for finding - maximum potential yield on any one crop with multiple years of yield data

Quick Notes for GPS—In Field General



Starting—New Field

1. Click on the **"Log & Sample"** button.
2. Select the Grower, Farm, and Field you want to work with.
3. Turn on the Maps that you want to work with.
   - Put a "Check" in front of the name
   - Example— 

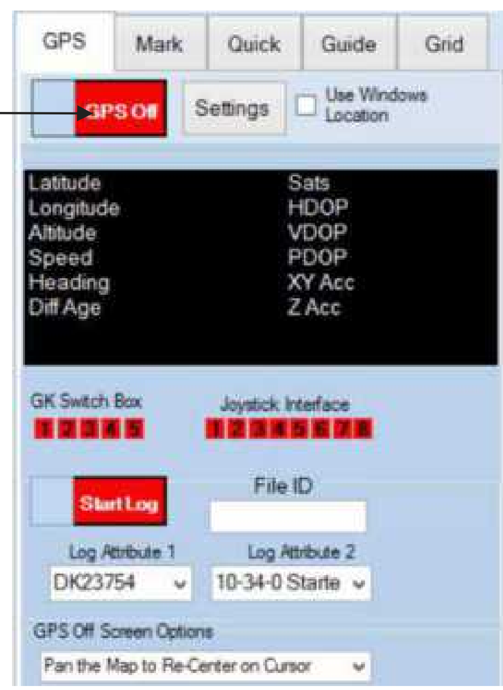
     ⇒ Need Zones on for sampling

More data is not a bad thing, use what you like.

Connect GPS

4. Go to the **"GPS"** tab
5. Connect GPS— 

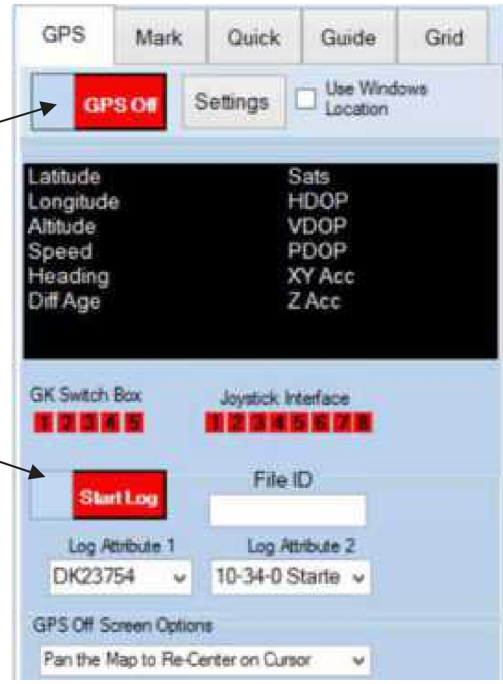
6. Your cursor will show you your location on the screen to the Right Side.



Quick Notes For GPS—In Field QM Points

Starting New Data Collection

1. Open "Map Window" or "Log and Sample."
2. Select the Grower, Farm, and Field you want to work with.
3. Turn on the Map that you want to work with.



Connect GPS

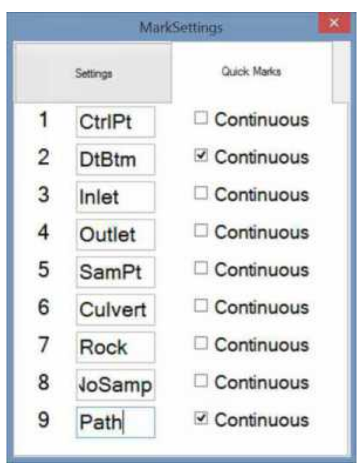
4. Go to the "GPS" tab 

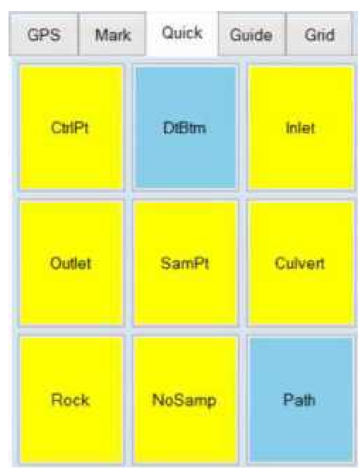
5. Connect GPS— 

6. To Collect Topo—"Start Log" ▶ "Log Path" 

   ⇒ *This is your Topo "Collection"*

7. If you want to mark other "Points" - Go to the **"Quick"** tab
   a. Naming Quick Marks—Go to the "GPS" tab
   b. Click on Settings Button
   c. Recommend settings like below
   d. Name "Quick Marks" as you see fit
      i. Limited to 8 characters
      ii. Continuous—Will collect a point every second or every 2 feet.



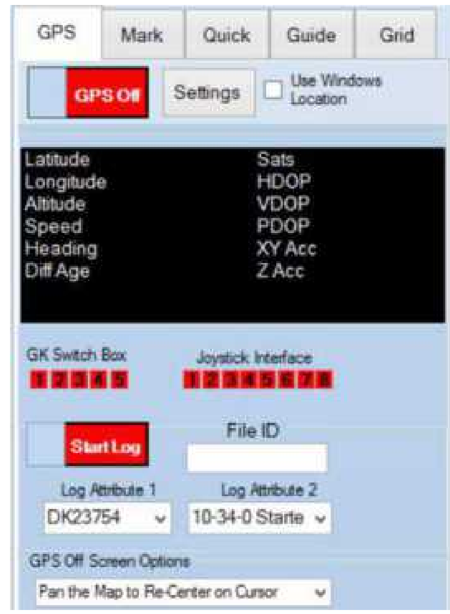


8. To use the Quick Marks, simply click on the button you want to mark.
9. Go to your new field and start at the top of the page.

Quick Notes For GPS—In Field Lines & Boundaries

Starting a New Data Collection

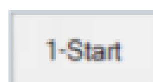
1. Open the "Map Window" or "Log and Sample."
2. Select the Grower, Farm, and Field you want to work with.
3. Go to the "GPS Mark" tab.
4. Under the "GPS" tab *Connect to GPS*.
    a. Click—**Connect GPS (top button)**



Marking Lines & Boundaries

5. Go to the "GPS" tab 

6. Go to the "Mark" tab 

7. "Select a Destination" (ex. Boundary)
8. Move to the location in the "field" where you want to start collecting data.
9. Click "1-Start" to begin collecting your line or boundary. 

10. Click "3-Stop" when you get to the end of the line or boundary. 

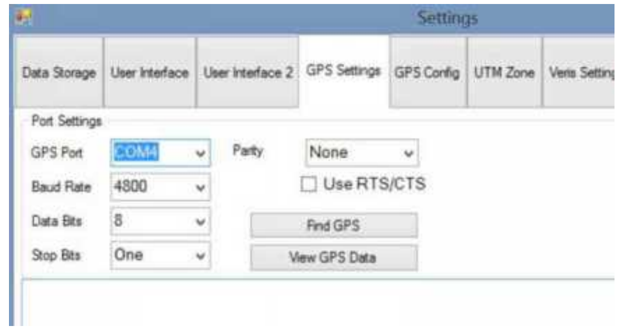
11. Repeat previous 2 steps until you finished collecting the lines or boundaries.
12. When finished with the field. "Stop" GPS and close the software and start over at the beginning at Step 1.

Quick Notes For GPS—Setup Instructions

Before starting to use the GPS functions in Ag Data Mapping Solutions you must find out what your GPS is putting out for information. (Some systems require a "NULL MODEM" "Trimbles.")

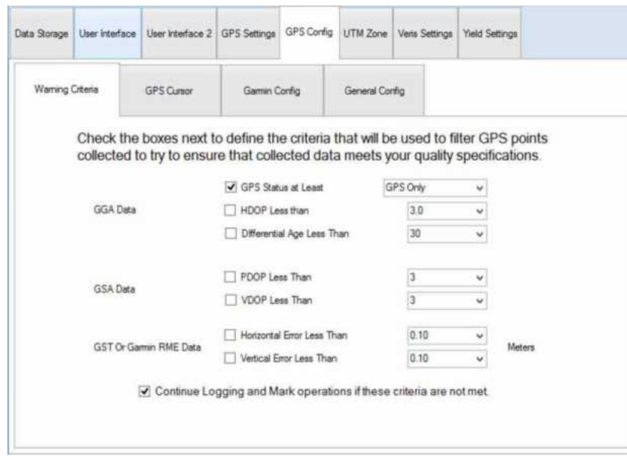
Your PC GPS Settings =

GPS Port
Baud Rate



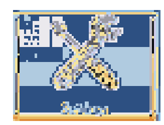
Baud Rate—Find out what the baud rate is set to. (To collect at 5 Mhz you must be set to 19200 or higher on your Baud rate)

Mhz of 1 = sneds out information 1 per second. Mhz of 5 = 5 per sectiond and 0.5 = 1 every 2 seconds.



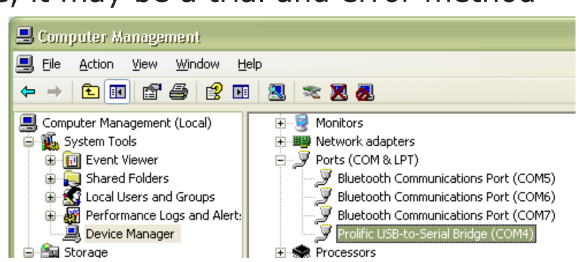
3 GPS NEMA Strings (required)
(National Marine Electronics Association)

-GGA—GPS fix location, supplying Longitude, Latitude, number of satellites, signal quality, and altitude.
-GSA—GPS quality DOP (dilution of precision) of active satellites.
-RMC—GPS time, date, speed, and heading information. If RMC is not available **VTG** can be used and the data and time will come from the computer (RMC is preferred).



With Ag Data Mapping Solutions running, go to the "Settings" button and go to "GPS Set tings" (pictured above).

1. **GPS Port**—To find out what your Com (Communications) port # is, got to your "My Computer" icon ► Right Click ► Select "Manage." This will open your "Computer Management" window. Select "Device Manager" and "Ports (COM & LPT)." You should see a series of PORT numbers similar to below. Pick out the one that matches the port you are connecting to. If you are unsure, it may be a trial and error method in Ag Data Mapping Solutions.



Suggest Using ► 

2. **Baud Rate**— set value to match the "GPS RECIEVER."

   i. NOTE: "Find GPS" button will find the "GPS PORT" and set the "BAUD RATE."

3. **Data Bits (8) - Parity (None) - Stop Bits (1) -** should always be set like this.

4. **Minimum GPS Quality**—set to either "GPS Only" or "RTK Fixed."

VR Control Quick Start Guide

Selecting a Controller:

On the Controller Tab of the Controller Tab, you will see a Setup button.

This is where you select the controller that will be connected. You need to know the com port that the controller is connected to, the baud rates are pre-selected.

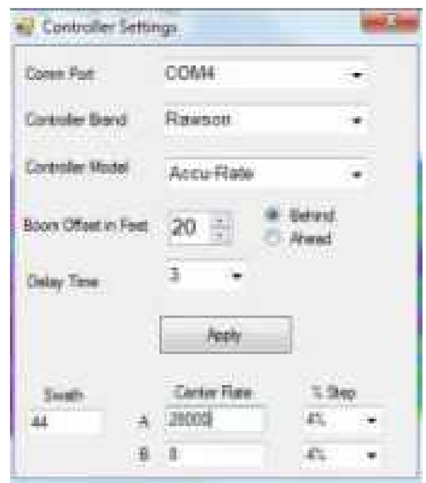
Select your Controller Brand and Controller Model and the Boom Offset from the GPS to the point of application in feet.

A delay time is provided for fine tuning the application. Since the GPS position that arrives at the computer is already where you were 1 second ago and it takes another second to send the rate to the controller and a couple of seconds for the controller to change rates, the delay time needs to be 3-4 seconds for most applications.

Several controller specific settings may also be on the bottom of the form.

The Variable Rate Unlock in Ag Data Mapping Solution provides for variable rate control with several aftermarket rate controllers. The current list includes:

- **AgTron Drill Manager**
- **GK Technology Relay Interface**
- **Hiniker 8605**
- **New Leader Mark III and Mark IV**
- **Raven 440, 450, 460, 660, 750, 760, 4000,4600,5000**
- **Rawson Accu-Plant and Accu-Rate**



Raven Configuration:

For Raven controllers to function properly, several settings need to be made in the data menu.

Refer to the individual product manual for additional help making these settings.

Applications are made with switch in Rate 1 position.

- **Trigger Units** **Seconds**
- **Trigger Value** **1**
- **Baud Rate** **9600**
- **DLog** **On**

The required cable connection varies by model and can be found in your Raven manual. Or contact us for assistance.

Rawson Configuration:

Rawson controllers need to be set to GPS mode. The value that has been set for the center rate position, and the Step Percentages and the swath width need to be entered in controller setup.

The cable required is a straight through male-female serial cable.

GK Technology Relay Interface:

Contact us for more information. The relay interface can be configured to trigger clutches or valves or trigger other events based on values in a map.

The controller is a pass through device that lives on the same serial port as the GPS.

VR Control Quick Start Guide

Start GPS:

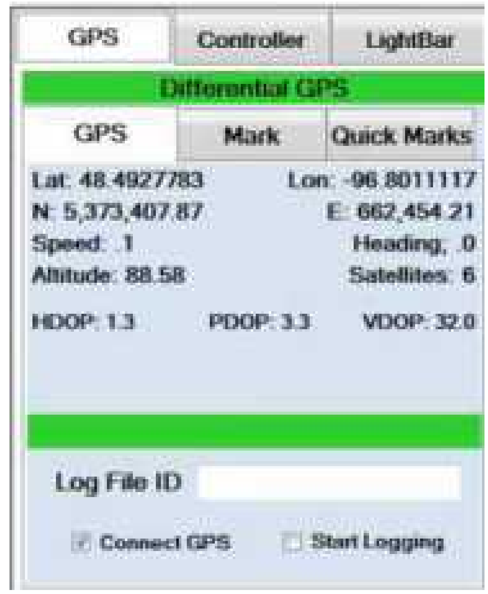
On the main map window, click "**VR Control**" to start. Note that there are three main tabs; **GPS**, **Controller** & **LightBar**.

Under each of the tabs, there are three tabs. In the case of the GPS tab, you can see that they are GPS, Mark, and Quick Marks.

The first tab to display will be the GPS tab.

GPS port and connection information is displayed in the Preferences tab of the main program.

Click Connect GPS. When GPS Status is good to go, the Status bars will be **green**.



Select Prescriptions:

Use the drop down boxes to select the Grower, Farm and Field. When you have the proper field, the data available for that field will be displayed in the tree. Prescription files can either be .grd or .bmp files.

Check the box next to the file to load it. Depending on the application, you may be loading more than one file. Also, a file may be inside a folder. If it is, you will need to click the "+" sign next to the folder to open it.

The toolbar on the bottom of the data tree has a few tools used for maintenance. The last button, a red **X** on the toolbar, is a button to clear the map between fields.

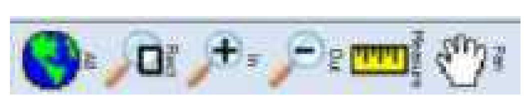
Start Controller:

Below is the interface for tying a map to a channel on a controller. In this case, the controller only has one channel. Maps that have been loaded show up in the drop down box that currently is displaying "None". Assign the map to be applied to the controller channel doing the application.

You can add other information about the application in the App ID box. You can also select Spray-Spread-Seed-Other, to add additional information to the file name that contains the as-applied data.

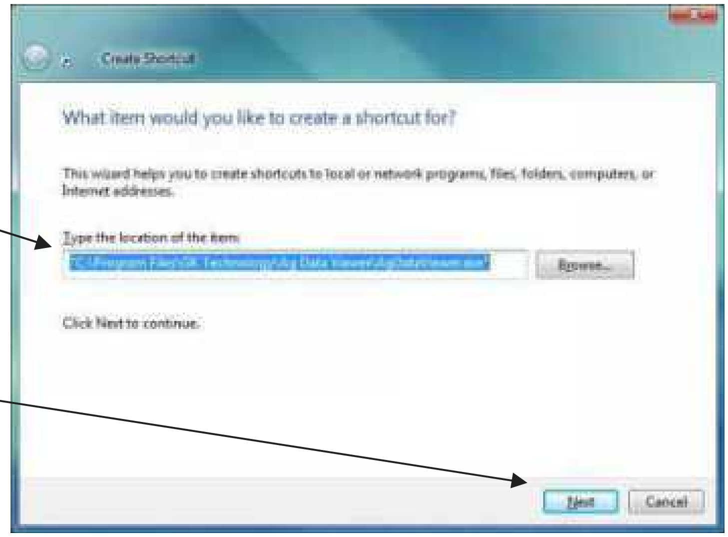
Check the box next to Connect to start the controller. Then click the **"Run"** tab to display the tab that will show a summary of what is happening with the controller and the GPS.

Click the globe on the toolbar to zoom out to the whole field. See the Ag Data Mapping Solution help file for assistance with the other buttons.



Run ADMS As Administrator

Creating a Shortcut for ADMS to run with Administrative Privileges



1. Right click on your desktop - select New Shortcut.

2. Click Browse, then browse to: "C:/ProgramFiles/GKTechnology/AgDataViewer/AgDataViewer.exe".

3. Click "Next".

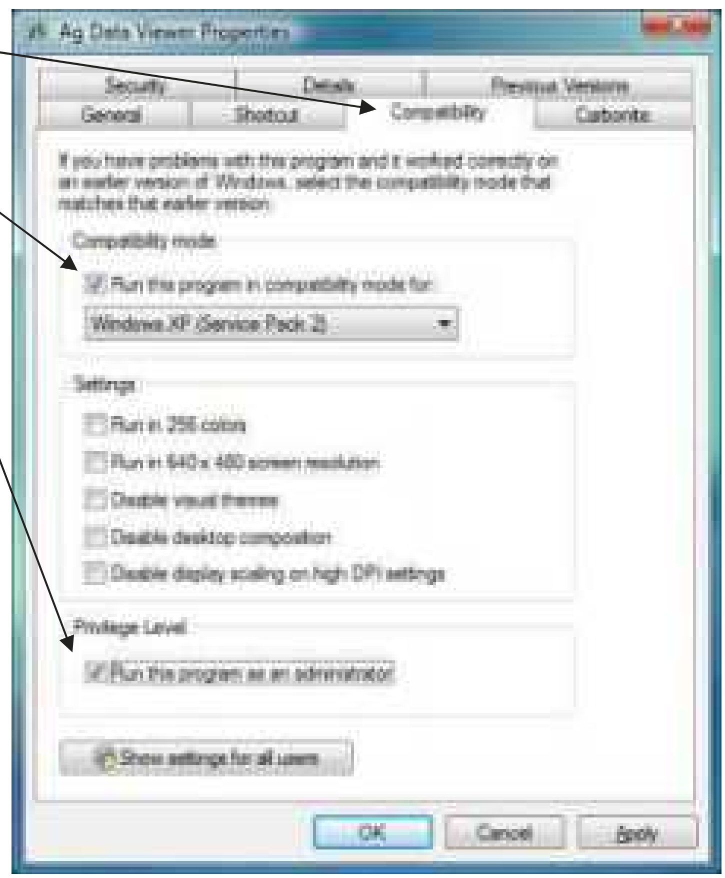
4. Name the shortcut "Ag Data Mapping Solution".

5. Right click on your new shortcut to Ag Data Mapping Solution, click "Properties".

6. Click on the "Compatibility" tab.

7. Check the boxes for: Run this program in compatibility mode for: Window XP (Service Pack 2) - Also check the box for "Run this program as an administrator".

8. Click "Apply". When Ag Data Mapping Solution is started, it will be able to access the registry where the information for starting the program is stored.



Hardware Setup

The cable connection between the Veris box and the serial port of the PC requires hardware handshaking, so a full 9 pin serial cable is required. (A full 9 pin null modem adapter may also be required.)

Once you get to the bottom of this page you can adjust the configuration in the settings window.

Press Any Key	Veris 1.77d You have 6088 min. available Press any key
Press the #2 Key	1) Download/Delete old files 2) Continue
Press the #2 Key	1) Begin data acquisition 3) Probe 2) Output to external PC 4) Quit
Press Any Key	Press any key to start (Any key to stop)
Up and Running	SERIAL OUTPUT ONLY Shallow: 10.5 Not storing data Deep: 15.3

Cables

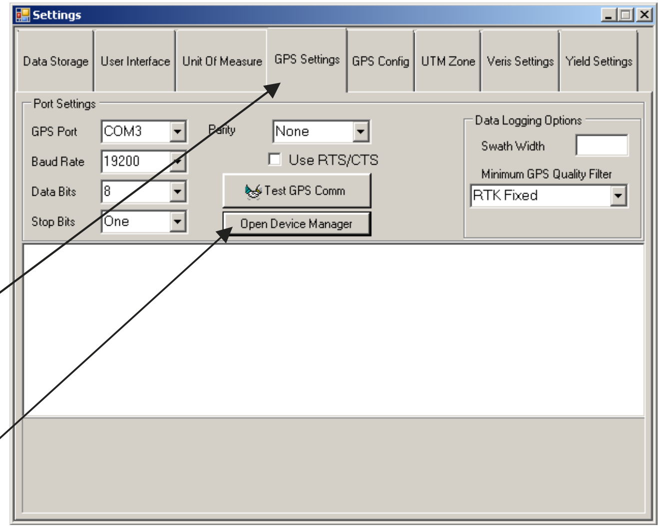
DB9 F-F 25

DB9 AD M-F NM

Both of these items are available at http://www.yourcablestore.com/. We also have these in stock.

Any good precision ag tool kit should contain several of these setups along with various gender changers, which are also available on this site.

Veris Logging



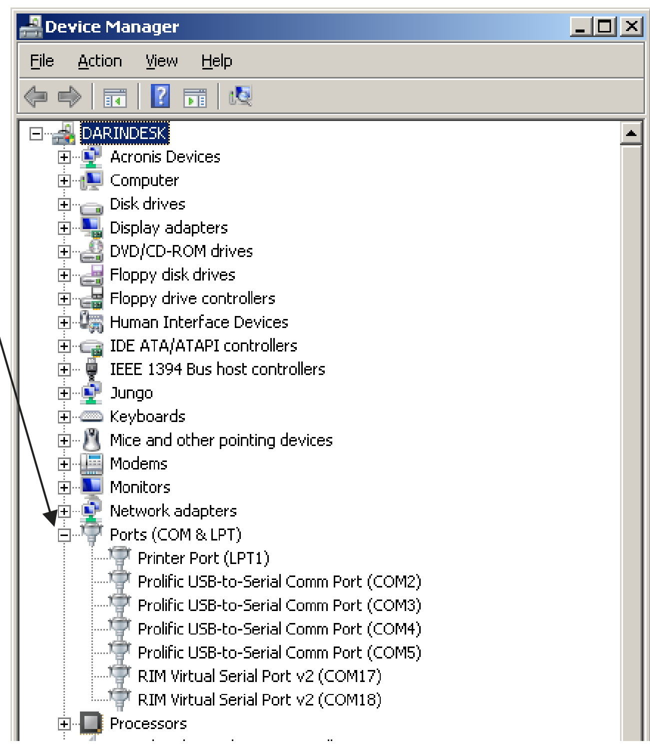
Software Setup

Settings for Veris logging mostly have to do with obtaining the proper communication ports to which the equipment is connected.


Settings

On the main screen of Ag Data Mapping Solution, click the **"Settings"** button, or click Tools-Preferences. The dialog to the right will appear. Click the **"GPS Settings**" tab.

If you do not know the comm ports that are available on your system, click **"Open Device Manager",** click the **"+"** sign next to ports. You can see that on my system, I have 4 useable com ports COM2, COM3, COM4, and COM5.



Many computers will have a long list of Bluetooth ports, either write down, or make a mental note about what is available. COM17 and COM18 on my computer are serial ports on my Blackberry. You can then close the "Device Manager" dialog.

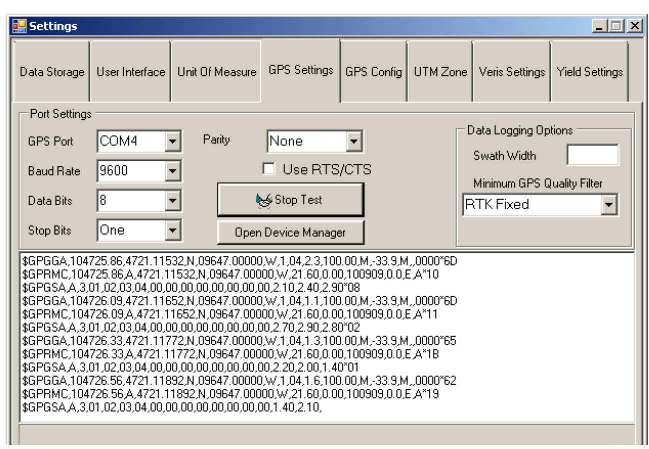
Choose a COM port and baud rate selection. Data like that in the dialog below should appear. Click **"Test GPS Comm".**

Data may or may not appear in the white text box.

If nothing appears, then the wrong port is probably selected.

If foreign garbage characters appear, you probably need to change baud rates. Close the port between baud rate changes. **"Stop Test"**.

When data appears like in the dialog to the right, GPS settings are done.



Veris Logging

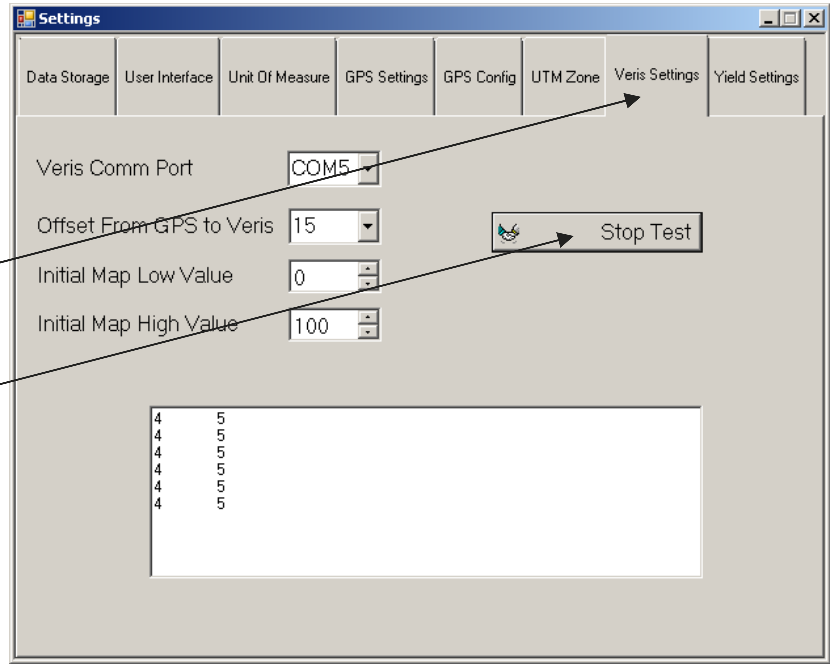
Software Setup

Next, we move on to selecting the comm. port for the Veris.

With the Veris hooked up and in the mode to log to an external computer, click on the **"Veris Settings"** tab.

The baud rate is fixed so it is just to select the port. Select a port and click the **"Test"** button.

If you see numbers coming in the white box on the bottom, the settings are successful.

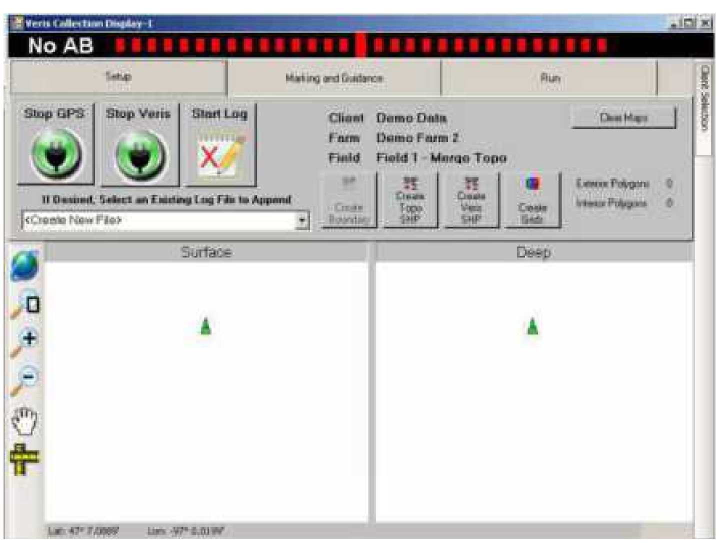


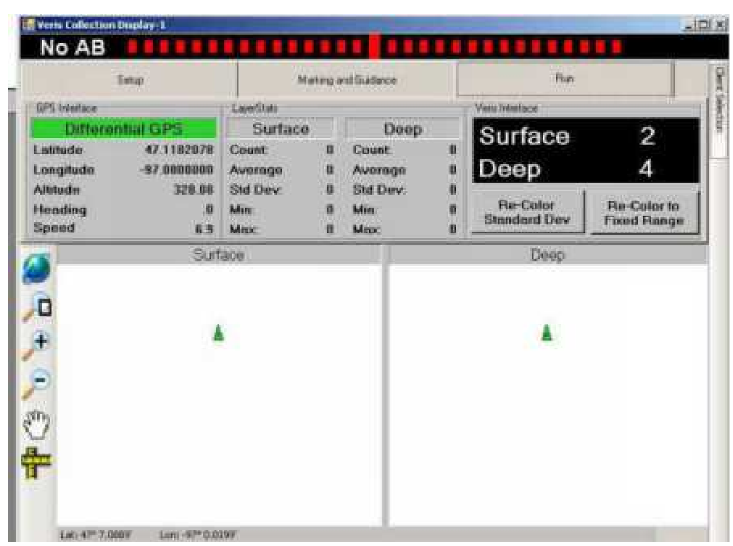
NOTE: The Veris box will not output data if both numbers are at −1.

I throw a wet towel across the inner four discs if I am on pavement. If you are in the field, just drop it in the ground. If the wet towel does not work, take it outside and drop it in the ground and run it to clean the discs.

You can now close this dialog box, and open a Veris Logging Window. On the Set-up tab, Click **"Start GPS"** and **"Start Veris".** Then, buttons should turn from red to green, and if you click on the "Run" tab, you should see values in the Veris display as well as the GPS interface box.

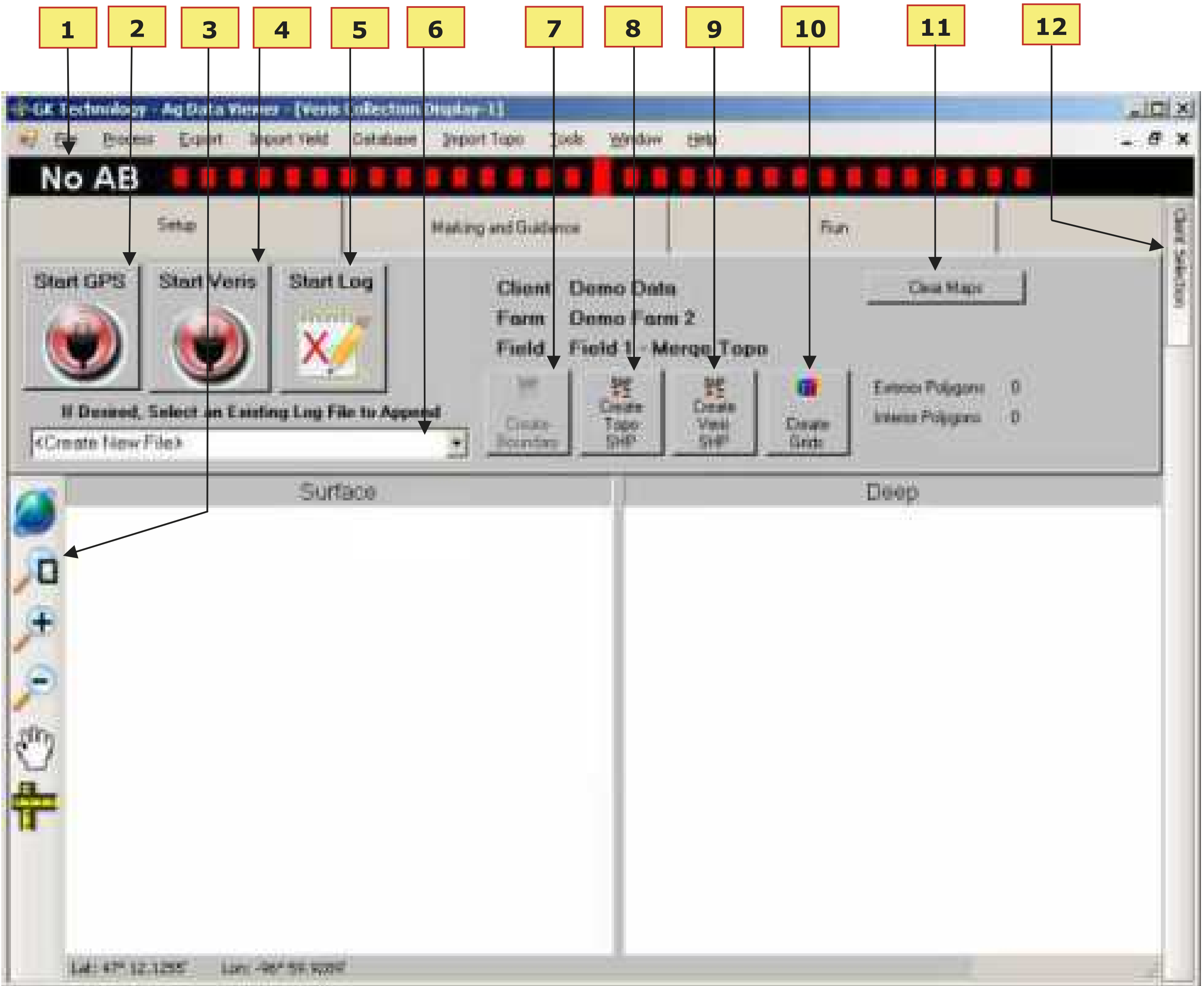
If you are using a USB to serial converter, you should note the USB port that you are using, and use that port every time. If you plug it into a different port, your com port numbers will change.





Veris Logging

Items on the "Run" tab



1. Light Bar Display
2. Start-Stop GPS Button
3. Map Scaling Toolbar
4. Start-Stop Veris Button
5. Start-Stop Log to File Button
6. Open an Existing Log File
7. Create Boundary Button from Logged Data
8. Create Topo Shapefile from Logged Data
9. Create Veris Shapefile from Logged Data
10. Create Grids from Logged Data
11. Clear Maps
12. Client Farm Field Selection Dialog

Downloading USDA Geospatial Data

1. Go to the USDA Geospatial site - http://datagateway.nrcs.usda.gov/
2. On the top menu select "**Get Data**".

3. Select the "State" you want to work in
4. Select the "County"
5. Click on the Button to the "Right" labeled "Add Counties to Your Selected List"

   Note: can select multiple counties so you don't have to repeat this procedure. Limit to FTP size of request 8 GB of Data.

6. Click "Submit Selected Counties".

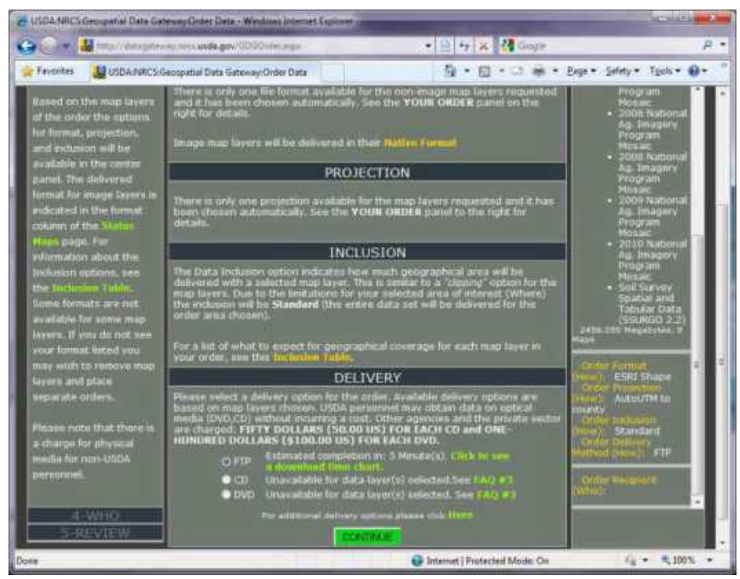
Downloading USDA Geospatial Data

7. In the "What" to download window, check the items listed below & to the right.

— Suggested Download Items —

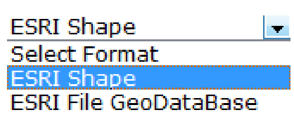
- Public Land Survey System (PLSS) Townships
- Public Land Survey System (PLSS) Sections
- National Elevation Dataset 3 Meter
- National Elevation Dataset 10 Meter
  Also download Quadrangle Index 1:12,000
- National Elevation Dataset 30 Meter (60 meter AK)
- Geographic Names - Populated Places
- Geographic Names - Non-Populated Places
- NRCS Counties by State
- Digital Ortho County Mosaic of 7.5' quads by NRCS
- 2003—2014 National Ag. Imagery Program Mosaic
- Soil Survey Spatial and Tabular Data (SSURGO 2.2)
- Digital Raster Graphic County Mosaic by NRCS
- TIGER 2010 Streets

8. Once checked, click "Continue" button.



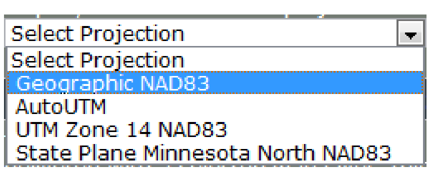
9. In the "How" window select the "FTP" button.

It may ask about File Type



It may ask about projection

- Geographic NAD 83 or WGS 84



10. Click "Continue" button.

Downloading USDA Geospatial Data

11. Type in the required fields. A download link will be emailed to you, so **<u>use a valid email address</u>.** This is a government site so you will not get spam by entering your information.

12. Recommended – Put a check mark in the "Save Contact Data" box on the Left side of the screen

13. Click the "Continue" button.

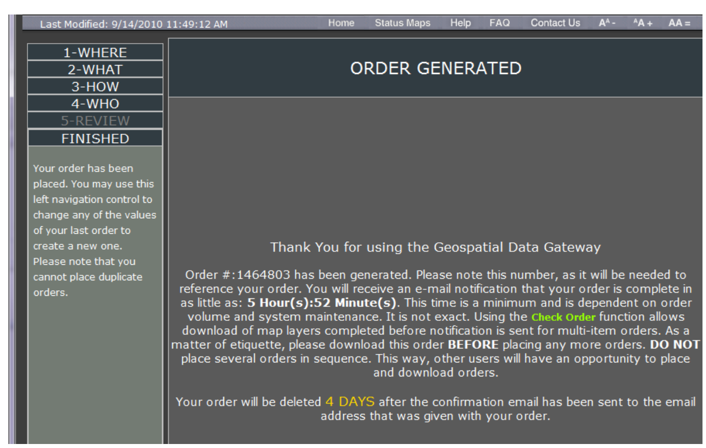
14. Review order and click **"Place Order"**.

15. Option 1 – Wait a few minutes and click on the "**Check Order"** link

16. Option 2 – Close the window and wait for the Geospatial email. This usually takes a couple hours to 3 days for all the items of the order to be processed and bundled for download (Go to step 21).

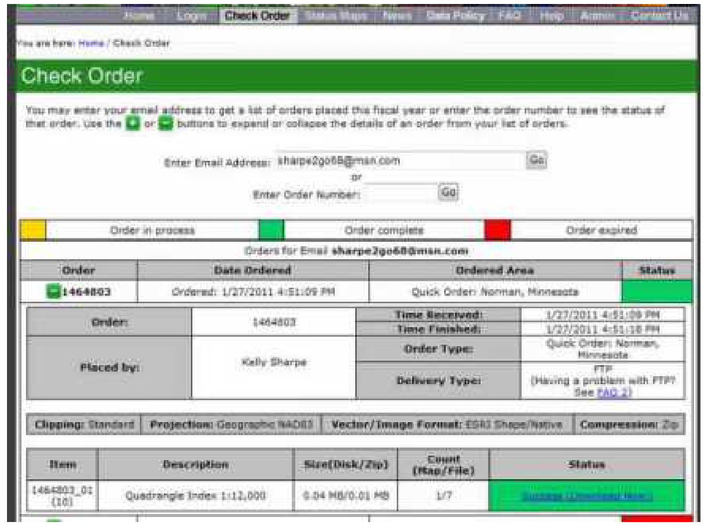
17. Check Order will bring you to a window where you click the "GO" button behind your email address.

18. Clicking on the "Success (Download Now)" button (Link), you will go directly to a FTP download link from the USDA site. You may be limited to the number of downloads you can do at a time due to file type, file size and connection speed.

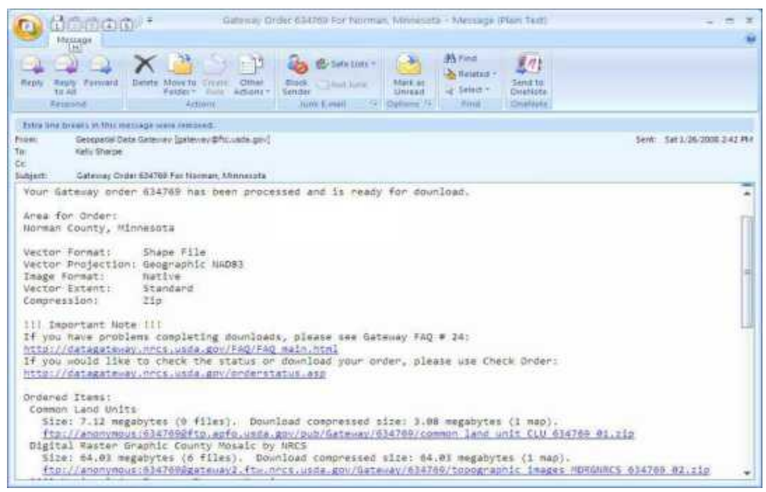


Downloading USDA Geospatial Data

19. Check Order will bring you to a window where you click the “GO” button behind your email address.

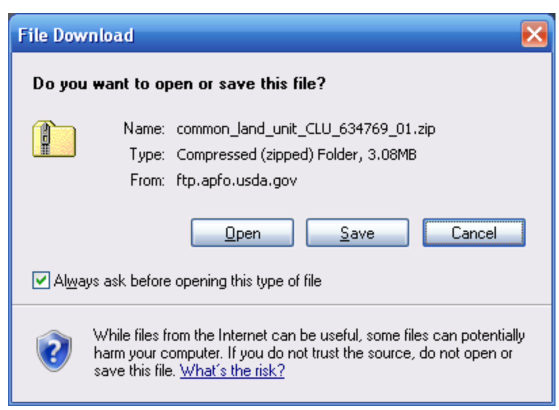


20. Clicking on the “Success (Download Now)” button (Link), you will go directly to a FTP download link from the USDA site. You may be limited to the number of downloads you can do at a time due to file type, file size and connection speed.



21. When the email arrives, click on the links to do the downloads. They will connect you directly to a FTP download link from the USDA site. (You may be limited to the number of downloads you can do at a time due to file type, file size and connection speed.)

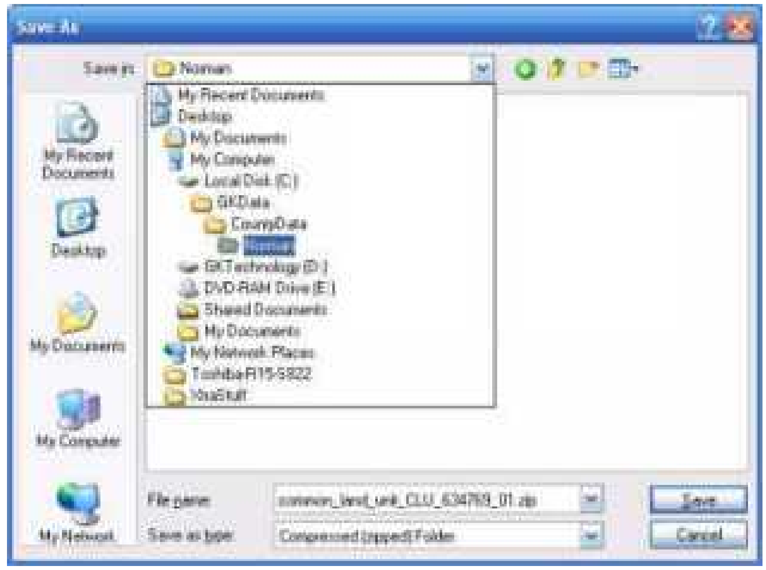
22. Click the **“Save”** button.



Note: Example using Internet Explorer 7. In newer IE 8 & 9 choose “SAVE AS”.

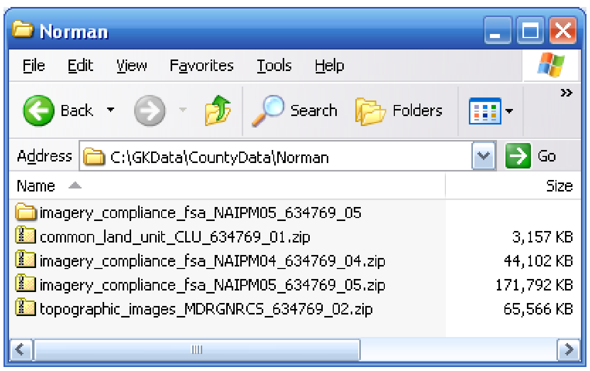
Downloading USDA Geospatial Data

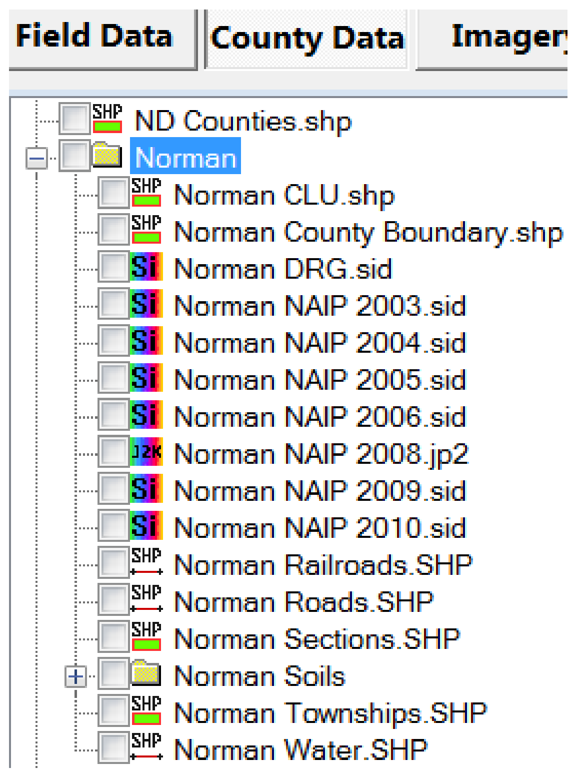
23. Save the files into the C:\GKData\CountyData\"Name of County" folder as shown to the right.



24. All of the downloads are .zip files. They must be unzipped or extracted.

25. It is recommended to rename everything and to create a file structure similar to the example listed below. This is done by dragging and dropping files in ADMS (once you have all the files unzipped).





Color scheme for DRAWING layers

CLU – 1 pt lines – LightSkyBlue—300'

Counties – 3 pt lines - Yellow—15,000'

Cities—2 pixel—Black / Red —3,000'

Places—2 pixel—Black / Red—300'

Railroads—1 pt lines—Black

Roads – 1 pt lines - Red

Sections – 1 pt lines – Lt. Gray—1,500'

Soils – 1 pt lines - Black—300'

Townships – 2 pt lines - Yellow - 4,500'

Water Lines – 1 pt lines – Blue

Using Web Based Background Layers—WMS Layers

Using WMS Servers

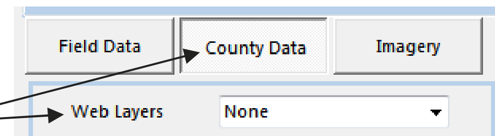
WMS servers are a web based map server that can be accessed through ADMS with an active internet connection. Most of them are state or region specific and are not available in all areas.

Finding WMS Links:
The easiest way to find new WMS links is by simply searching the web for them.

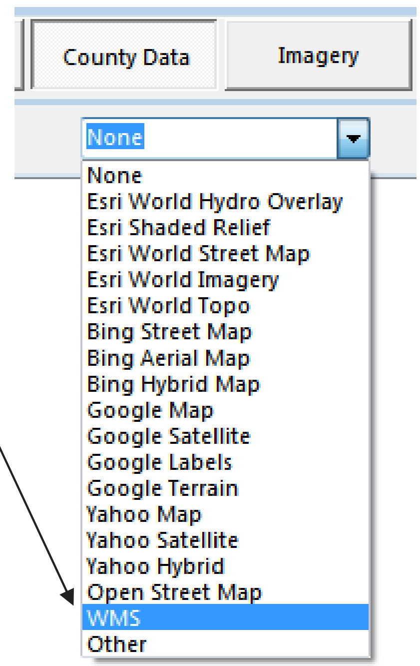
Here are some examples of WMS links:
MN: *http://geoint.lmic.state.mn.us/cgi-bin/wmsll?*
ND: *http://ndgishub.nd.gov/ArcGIS/services/All_Imagery/MapServer/WMSServer?*

Adding WMS Links:

Select "County Data" so the "Web Layers" dropdown is visible.

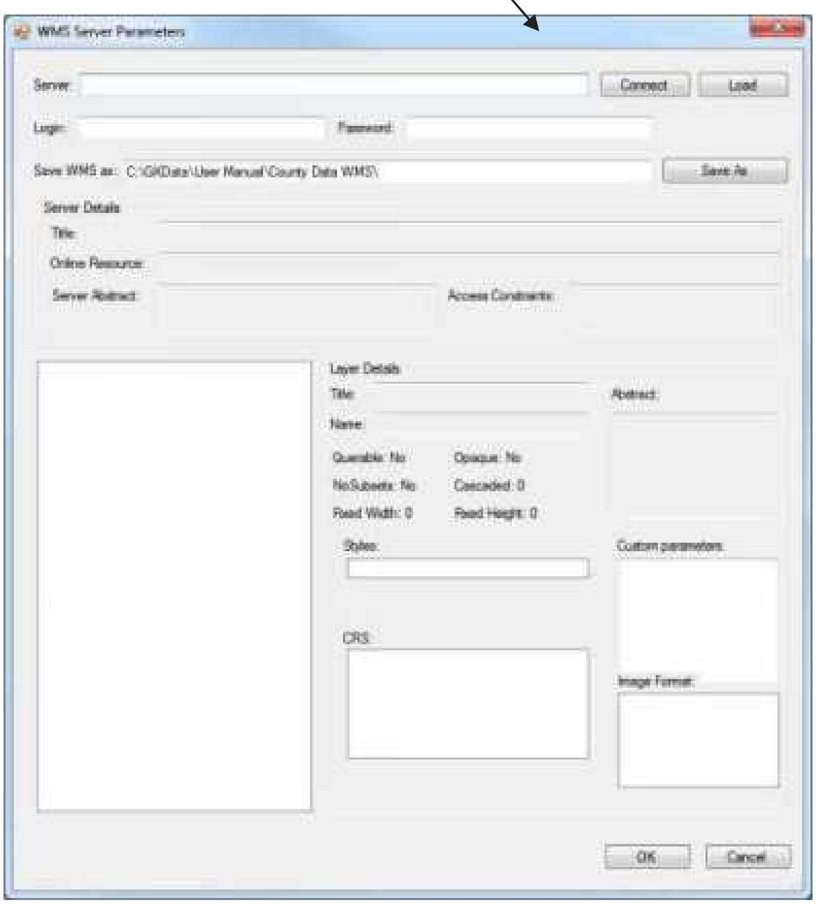


From the "Web Layers" dropdown menu select "WMS."



The "WMS Server Parameters" window will appear.

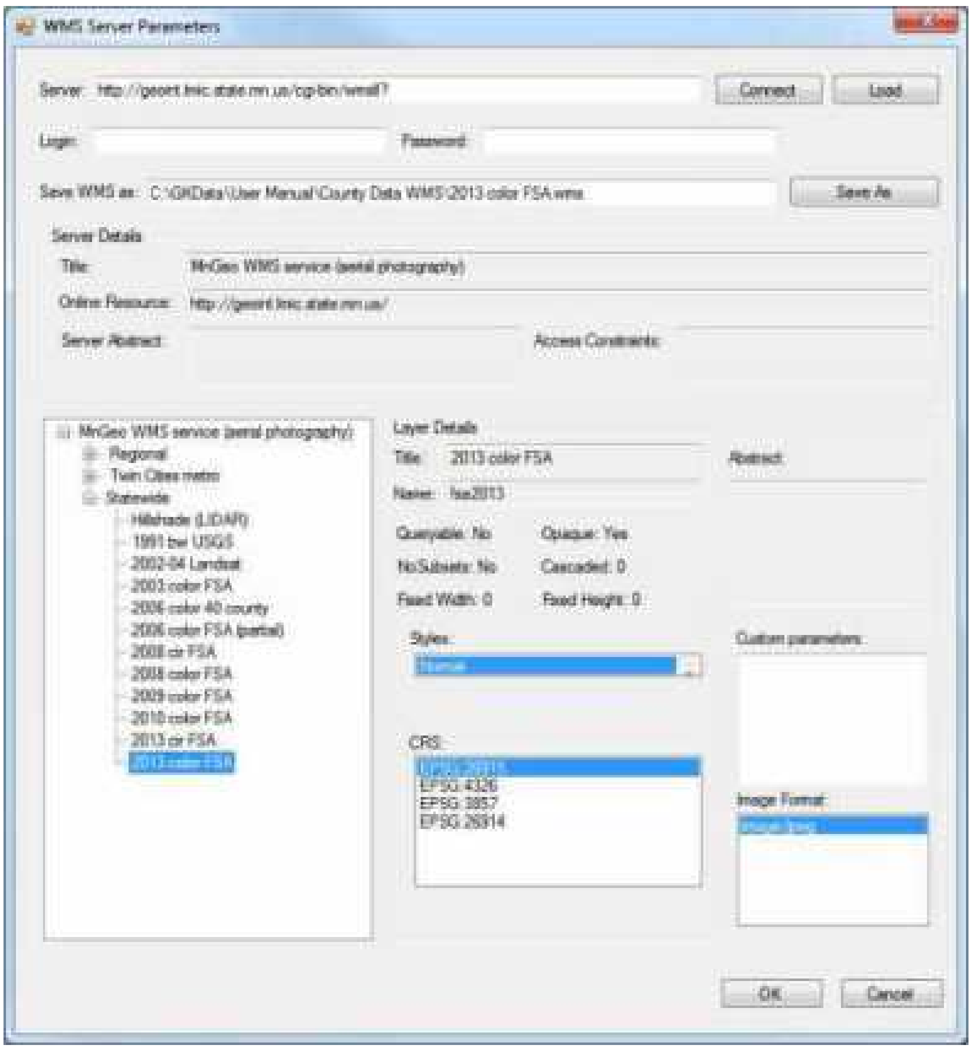
This window allows different links to be saved to the data tree and utilized within ADMS.



Using Web Based Background Layers—WMS Layers

The following example will use the MN WMS server link.

1. Enter the WMS server link where it says "Server."
2. Click "Connect."
   * Some servers need special authentication which may require a login name and password. If this is the case enter it before connecting.

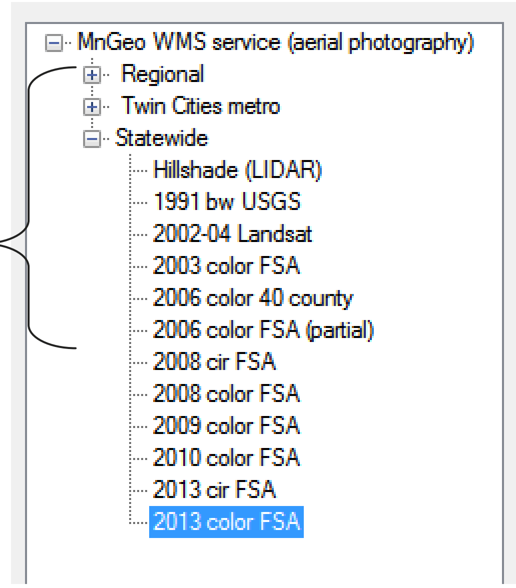


3. After successful connection to the server the window will populate with different options the layers are viewed and saved.
4. Different options may be available or lacking depending on which server is being accessed.

Using Web Based Background Layers—WMS Layers

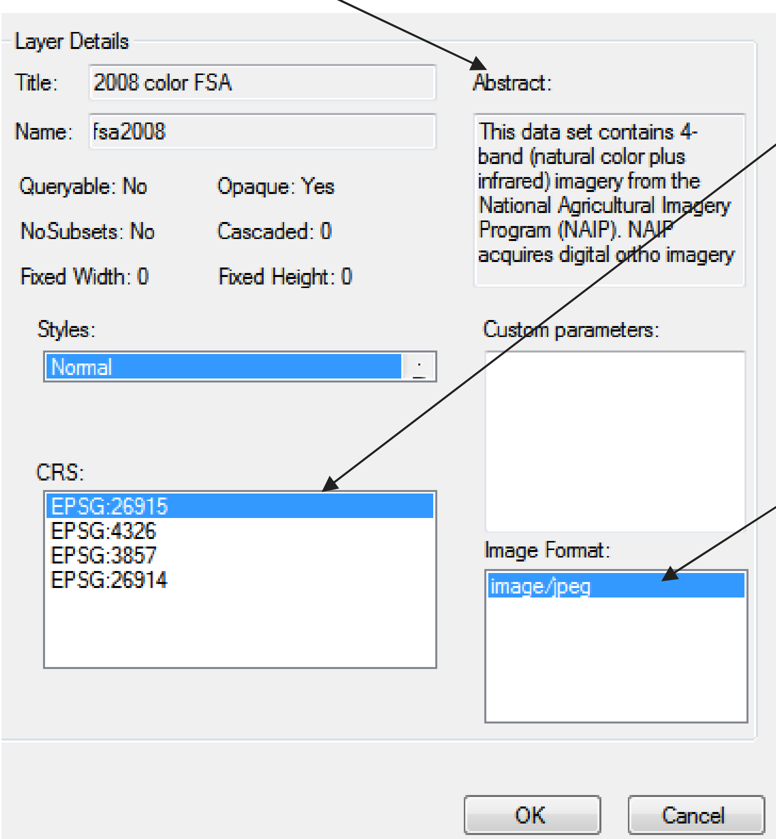
On the left side of the window the different layers that are available on this server will populate. Depending on the server they may range from one to many.

In this MN example there are different categories that break the images up into categories: Regional, Statewide, and Twin Cities metro.



Common acronyms that are used with these layers are:
CIR: Color Inferred—this layer contains a NIR, RED, & GREEN band.
Hillshade: This is a elevation derived shaded relief map.
Color (RGB): These will have layers with the RED, GREEN, & BLUE bands.
BW: Black & White layers.

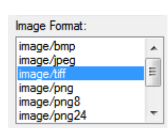
A description of the layer may be available in the Abstract like this 2008 layer.



CRS (Coordinate Reference System) is how the image is projected. By default the WMS layer will be projected in the UTM zone that is active. If the layer is not visible and should be it could be in an uncommon projection system and a different CRS can be selected.

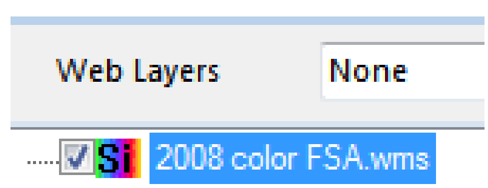
EPSG:26915 (NAD83 UTM15N)
EPSG:26914 (NAD83 UTM14N)
EPSG:32615 (WGS84 UTM15N)
EPSG:4326 (WGS84)
EPSG:3857 (Web Mercator)

Image Format: Some WMS servers will have options to select different image formats. Some are better quality than others. By default if image/tiff is available it will automatically be selected (because of quality this format is always recommended, but not always available as an option)



Example of different image formats from ND WMS server

5. Click "OK."
6. The image will be saved back to the County Data folder that is set as the root in settings with the title shown in Layer Details above.
7. This server is now ready to be used within ADMS.



Downloading & Processing USGS Imagery—GLOVIS

GLOVIS may not work with some internet browsers such as FireFox. You may also need to have your "Internet Explorer" Browser up to date to the latest version and also need JAVA enabled on your browser.

Go to **http://glovis.usgs.gov**

We recommend that you read through the GLOVIS Tutorial to get a full overview of the web site. The instructions listed below are for getting data into GK Technology Inc. – Ag Data Mapping Solution software.

If you are on a "Dialup internet connection", we recommend not using this site. Find a DSL or Broadband connection. Download sizes are 120 MB to 200 MB.

>>>>> Before getting started, either "Login" or "Register" <<<<<

Keep in mind Landsat imagery is Free.
There are images on this site that must be purchased and you will be charged for these other images!!!!
So pay attention to what you are clicking on and ordering.

Set "Select Collection" to **"Landsat Archive"** and **"Landsat 4-5 TM"** or **"Landsat 7 SLC-on (1999 to 2003)"** or **"Landsat 8 OLI"** *(note must download "Level 1 Products)*
These are usable Landsat Images – Other Landsat Images ***may not*** *work.*

Take your mouse and CLICK on the map where you want to get an image from.

Downloading & Processing USGS Imagery—GLOVIS

A new window will open.

Click on the **"Map Layers"** and Check "Cities" to help you navigate

Use the **"Arrows"** to navigate to the Scene you want to download

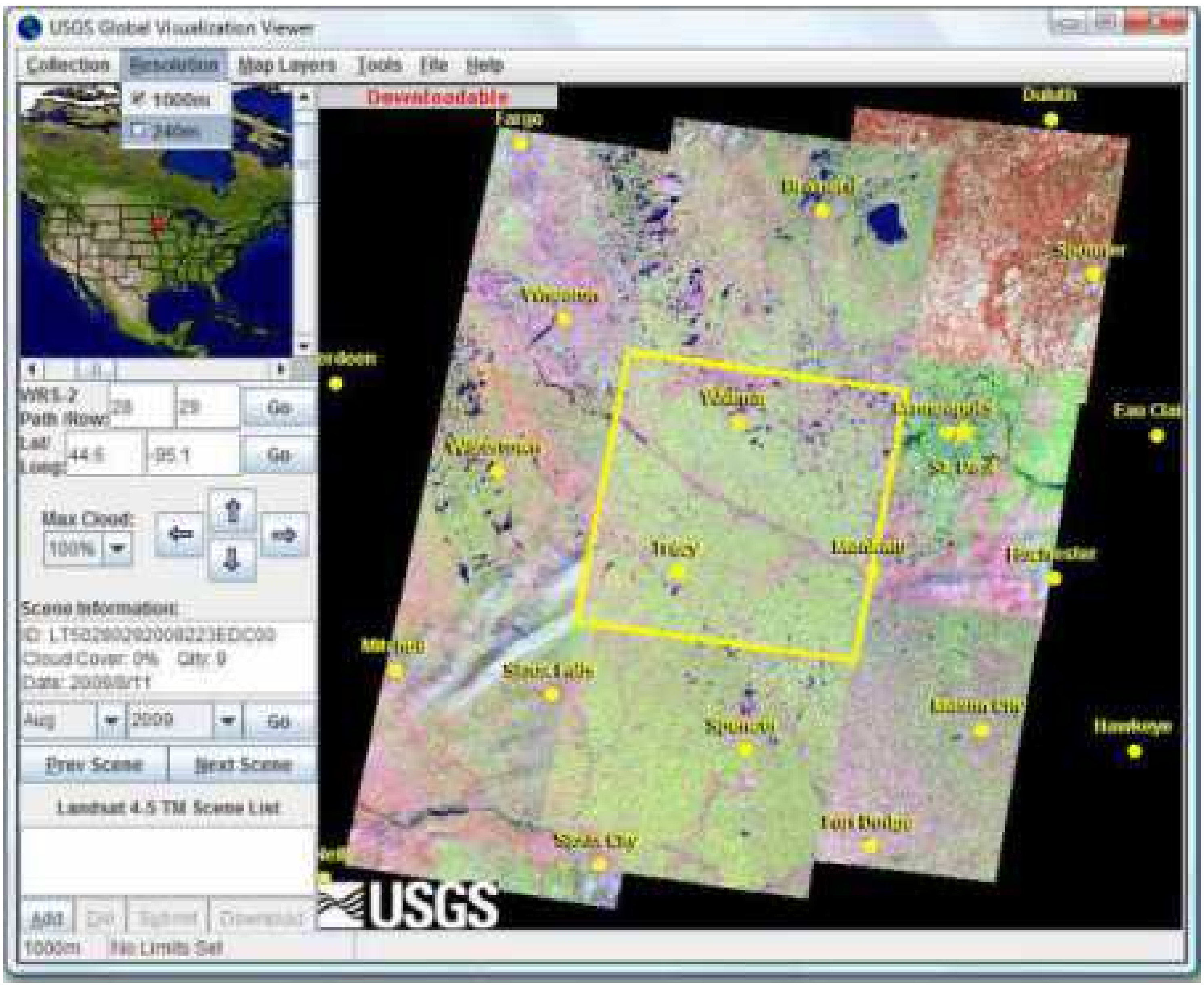
Click on **"Resolution"** and **"240m"** (give a larger view of the maps)

Choose your **"Month"** and **"Year"** and Click **"Go"**

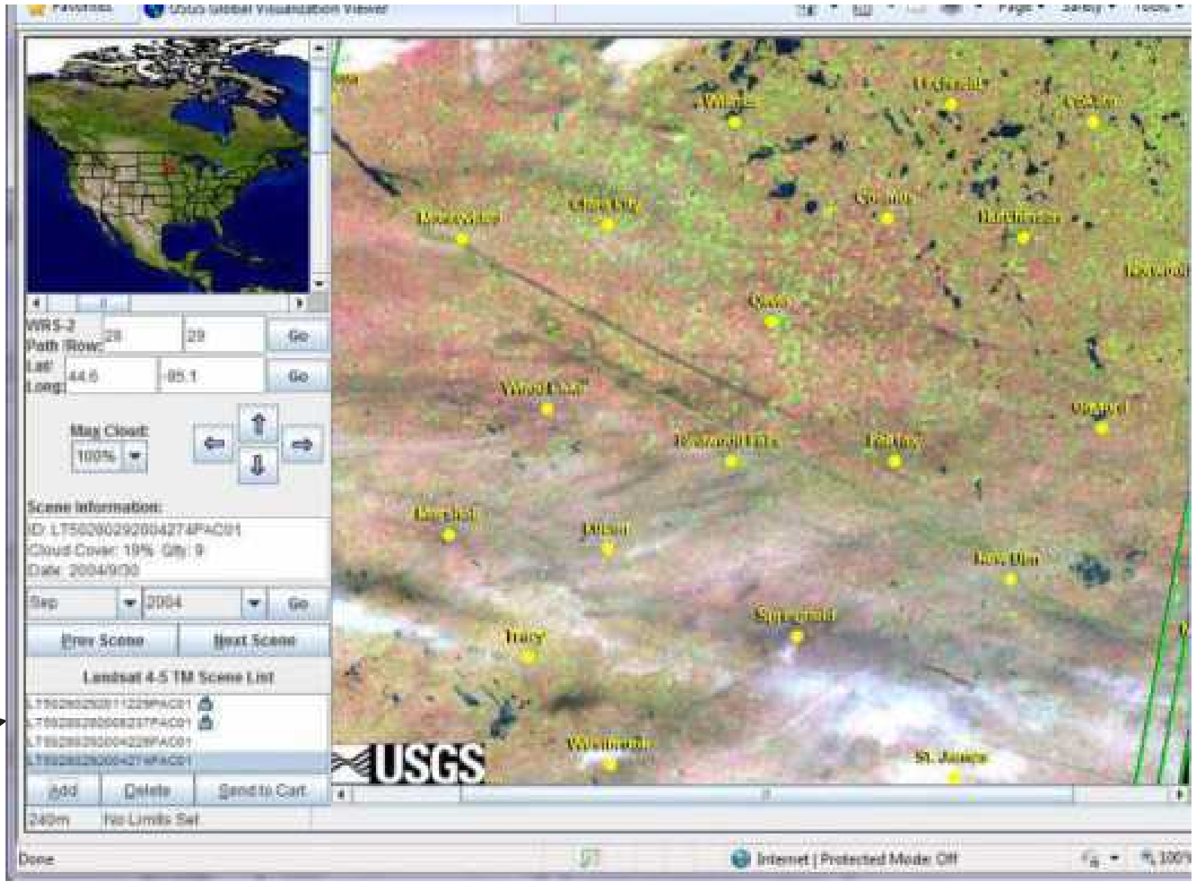
When you find a scene you want Click **"Add"**

Use the "Prev Scene" and "Next Scene" to scroll through the dates

Repeat these last 3 steps / keep adding the scenes for downloading.



Downloading & Processing USGS Imagery—GLOVIS



Once you have populated the "Landsat Scene List".

Items that show up with a "Lock" by them are ready to "Downloaded" - LT50280292009223EDC00 .

Items with "No Lock" will need to be submitted for downloading.

Once you have all the file selected into your "Scene List", click the "Send to Cart" button.

Click "OK" to the Notice…

Next Login or Register

Downloading & Processing USGS Imagery—GLOVIS

You are now in the "Item Basket—Pending Scenes" window of the USGS

Items in "Available Products" that has a "Level 1 Product" must be downloaded here & now. This is done by click on the download ICON

Items in "Available Products" that show "Order Products" must have a "Check Mark" in the "ORDER" column. Check all items like this and Click "Apply" at the bottom
Or
Check all the "Bulk Download" buttons & click apply. Note: Items that are NOT available for download will go to the Bulk Download. Available items must be downloaded now.

Do not "Go to Item Basket" button until you have downloaded all available images requested. Once all are downloaded Click the button.
Files may take 12 to 48 hours to be bundled for downloading.

Pending Scenes

Entity Id	Collection	Order	Bulk Download	Available Products	
LT50290302010233EDC00	L4-5 TM	☐	☐	**Bulk Products** LandsatLook "Natural Color" Image (5 MB JPEG) LandsatLook Thermal Image (6 MB JPEG) LandsatLook Images with Geographic Reference (11 MB JPEG) Level 1 Product (139 MB Geotiff)	
LT50290302010217EDC00	L4-5 TM	☐	☐	**Bulk Products** LandsatLook "Natural Color" Image (5 MB JPEG) LandsatLook Thermal Image (3 MB JPEG) LandsatLook Images with Geographic Reference (9 MB JPEG) Level 1 Product (154 MB Geotiff)	
LT50290302004201PAC01	L4-5 TM	☑	☐	**Order Products** L4-5 TM L1T/L1G ON-DEMAND **Bulk Products** LandsatLook "Natural Color" Image (5 MB JPEG) LandsatLook Thermal Image (5 MB JPEG) LandsatLook Images with Geographic Reference (10 MB JPEG)	
LT50290302004169LGS01	L4-5 TM	☑	☐	**Order Products** L4-5 TM L1T/L1G ON-DEMAND **Bulk Products** LandsatLook "Natural Color" Image (5 MB JPEG) LandsatLook Thermal Image (3 MB JPEG) LandsatLook Images with Geographic Reference (8 MB JPEG)	

Toggle All Bulk Download | Toggle All Orderable | Apply | Go to Item Basket

For BULK DOWNLOAD follow instructions from the USGS.

Under the "Downloads" area of the window

You will click on the Download Button - 

Download "Level 1 Product" Button

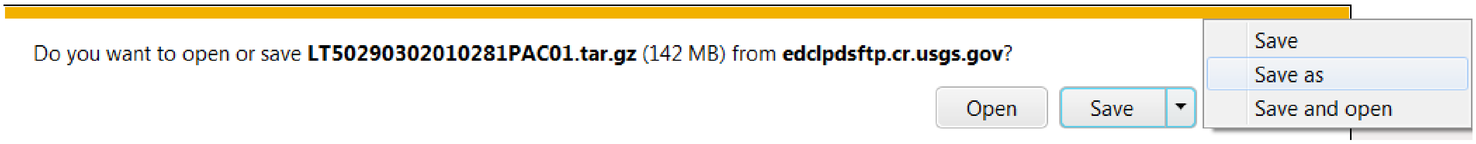
Download LandsatLook "Natural Color" Image (5 MB JPEG)
Download LandsatLook Thermal Image (6 MB JPEG)
Download LandsatLook Images with Geographic Reference (11 MB JPEG)
Download Level 1 Product (142 MB Geotiff)

NOTE: Other options here DO NOT work in ADMS.

Downloading & Processing USGS Imagery—GLOVIS

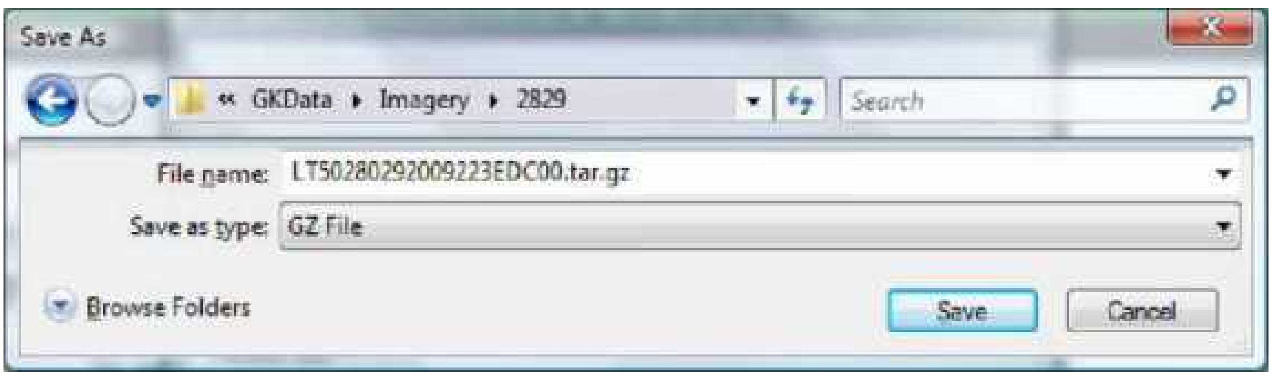
You should come to the "Downloads Bar" at the bottom of the window

Click "Save As"



This will open you into a "Save As" window

Save these files back to your C:/GKData/Imagery/LandsatScene# (Ex. 2829).



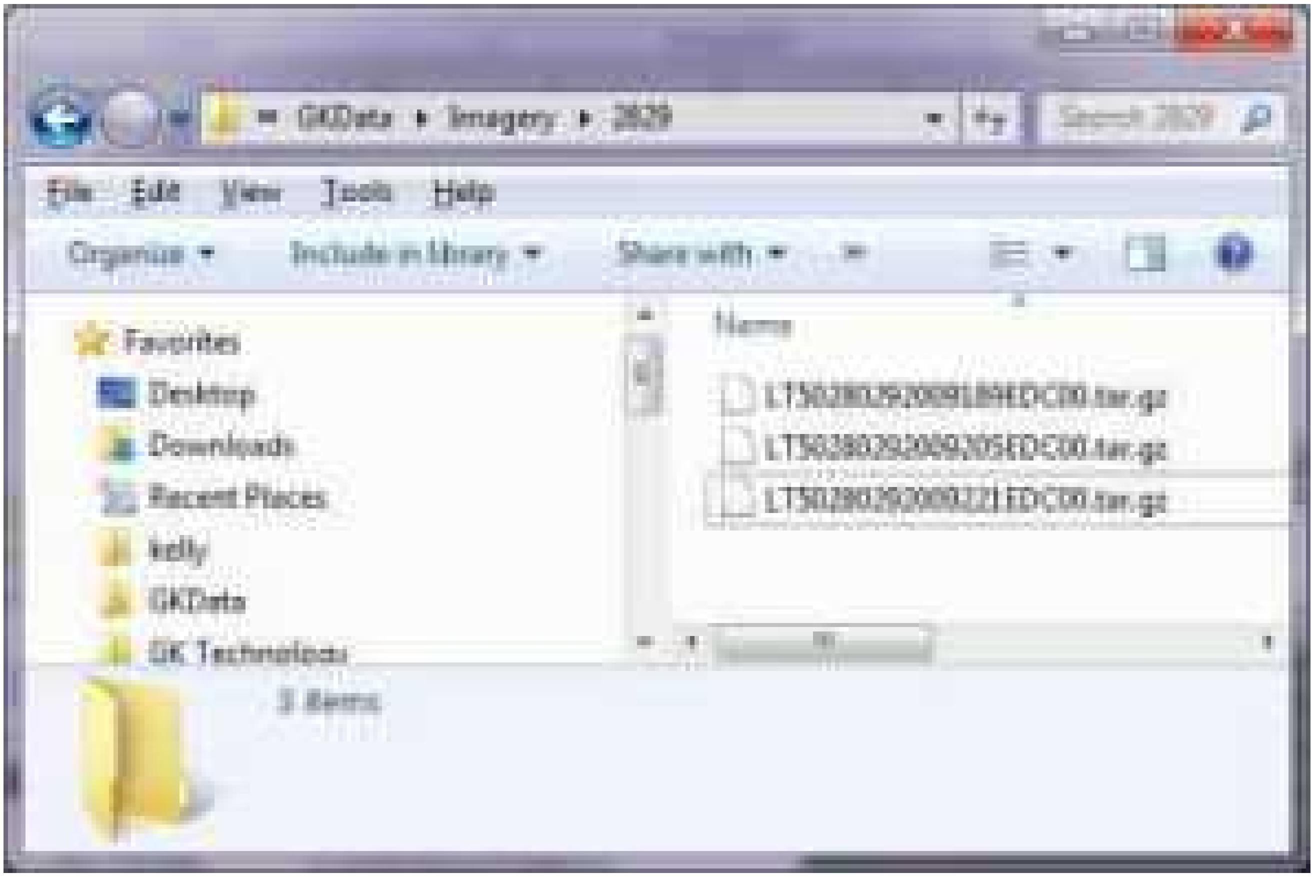
Leave the file names as they are (DO NOT CHANGE)

Click "Save"

For the scenes that were submitted. You will receive an email in the next day or two. Follow through the instructions on "Download" and you will get the files in the correct location.

Downloading & Processing USGS Imagery—GLOVIS

As you get things downloaded, you will end up with a folder looking something like this.



Next, follow the unzipping and extraction / processing instructions on the next couple pages.

Landsat Data Processing

Introduction:
Within ADMS there are different types of data that can be used for site specific field management. Among this data is satellite imagery. Landsat 5, 7, & 8 data is available for download from the USGS and can be utilized for creating management zones. When using this data there are some significant differences between Landsat 5, 7, & 8 that you should be aware of.

Landsat 5 & 7 (TM & ETM+)

- 8 bit images
- Values from 0-255
- File sizes – roughly 150 MB to 190 MB per image
- 7 bands of raw data (8 bands - LS7 ETM+)
- 30 meter resolution / band (120 meter on band 6)
- Fairly broad spectrum band widths

Landsat 8 (OLI)

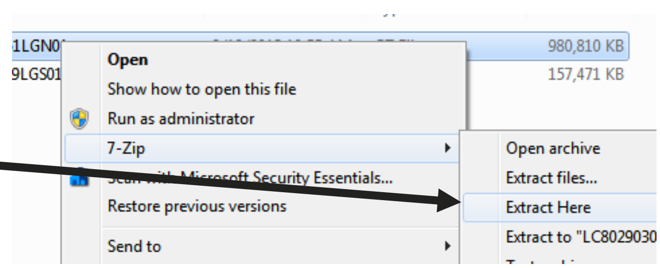
- 12 bit images distributed as 16 bit data
- Values from 0-65,535
- File sizes – roughly 920 MB to 980 MB per image
- 11 bands of raw data
- 30 meter resolution / band (100 meter on band 10 & 11)
- Tighter band widths

- All of these TIFF images will now be handled as GeoTiff images within the software.

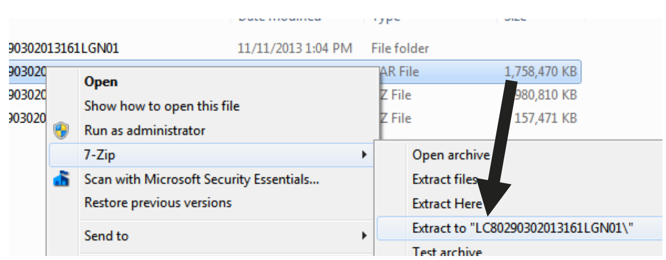
Processing the Data

Once the Landsat data has been downloaded, you will need to unzip it twice.

- ***The raw files will have the extension *tar.gz.***
- ***An unzipping utility will be needed for this process (7-Zip will be used in these instructions).***



1. Open Windows Explorer where the raw files are located.
2. Right click on the raw Landsat file.
3. Select 7-Zip, click **"Extract Here."**
4. A new file will be created with the extension *.tar.

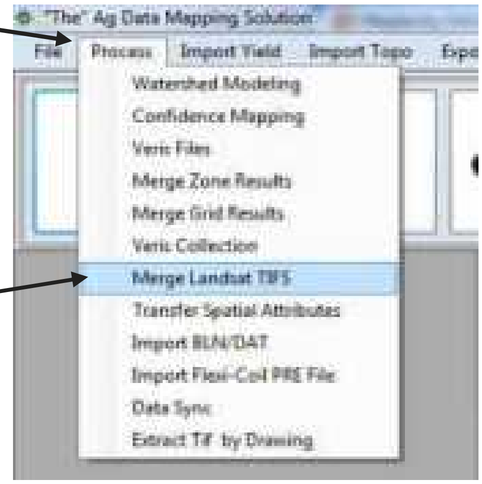


5. Right click, select 7-Zip, click **Extract to "*\"**
6. A folder will be created with the same name as the file.
7. Inside this folder will may have up to 12 different TIFF files depending on if the data is from Landsat 5, 7, or 8.

Landsat Data Processing—Merging Images

Merging Landsat Images

After the extraction process has been completed, the next step is to merge them into one image. This is done with a utility in ADMS.



- ***ADMS will recognize the correct band order for the different types of Landsat data.***

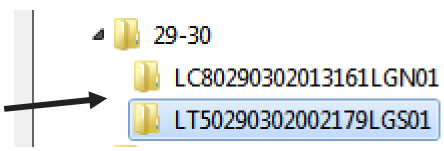
1. Open ADMS, the map window does not need to be open for this process.
2. Select "Process" from the top toolbar.
3. Select "Merge Landsat TIFs"

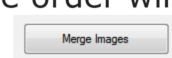
This will open the Landsat Merge Utility

**Scenes will be merged individually one at a time.*

Step 1: Browse to the folder containing the source Tif files to Merge

1. Select "Browse"
2. Select the **Folder** containing the extracted images. Click "OK."



3. The band orders will automatically be populated. The order will be determined by which satellite it came from. Click "Merge Images" 

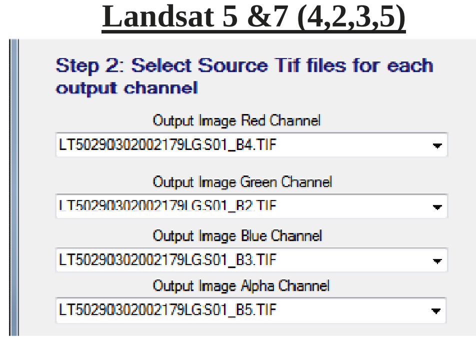
4. Repeat for additional scenes.
5. The images will automatically be named and be saved in the same location as the source folder.

   Example: **2002_JUN28_2930_L5_4235.TIFF**

*NOTE: It is recommended saving the original *tar.gz file. This will always allow you to go back if image processing ever changes.

Landsat 8 (5,3,4,6)

Landsat 5 &7 (4,2,3,5)



Landsat Data Processing—Cutting Images by Shapefile

Introduction:

Due to the fact that Landsat scenes are very large files (~200 MB, and 120 Miles^2), it is helpful to manage them on a smaller scale. This is most often done on a county basis similar to the county data. However, do not confuse the two.

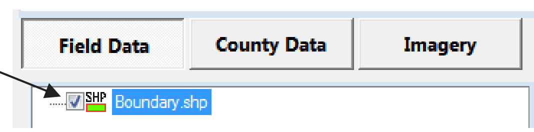
There are several advantages to doing it this way:

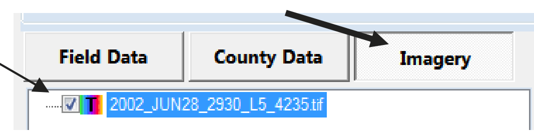
1. It allows the software to handle more images being loaded at once.
2. Images can be managed on a county by county basis.
3. Landsat scenes that overlap UTM zones can be easily re-projected so image processing is more consistent.

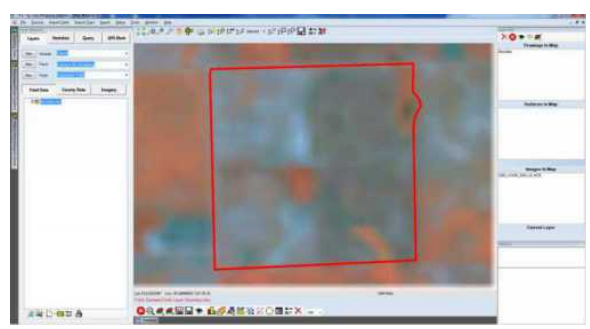
Preparing the Data For Clipping

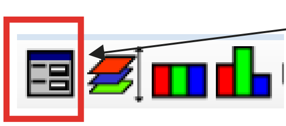
This is a very important step in this process. Each of the Landsat scenes are saved as GeoTiffs after they are merged together. Each file will have to have it's location updated and re-saved. This is done to each scene individually.

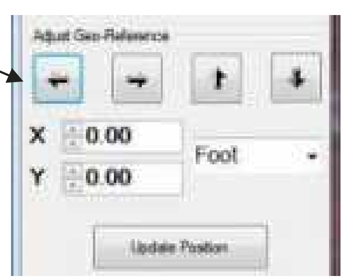
1. Make sure the imagery folder is set in the correct directory. (Settings, Browse to Folder)
2. Open up the map window. (Make sure the correct UTM zone is selected)
3. Turn on a boundary that is located in the scene.
4. Select the "Imagery" tab.
5. Turn on the Landsat scene that is going to be clipped.
6. The Landsat scene and boundary should be close to lining up with each other.
7. With the TIF file being the active layer, adjust the image according to the field boundary. Do this with the arrows located in "Image Properties."



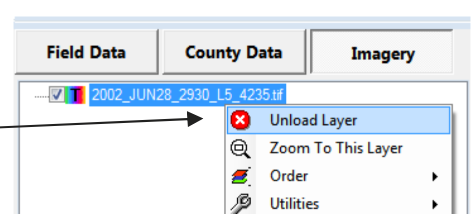








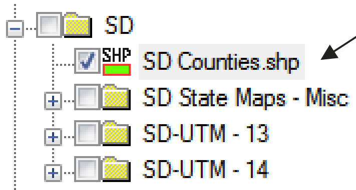
8. When the image lines up close to the boundary, click **"Update Position"** This will save and update coordinates of the GeoTiff.
9. If more images will need clipping, right click on the current TIF file and select unload layer. Repeat the process for any additional images.

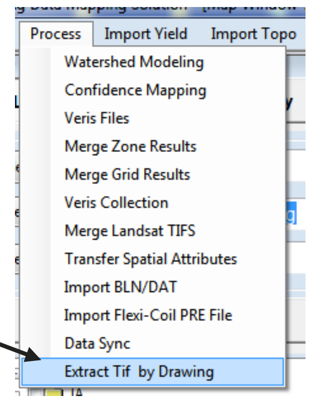


Landsat Data Processing—Cutting Images by Shapefile

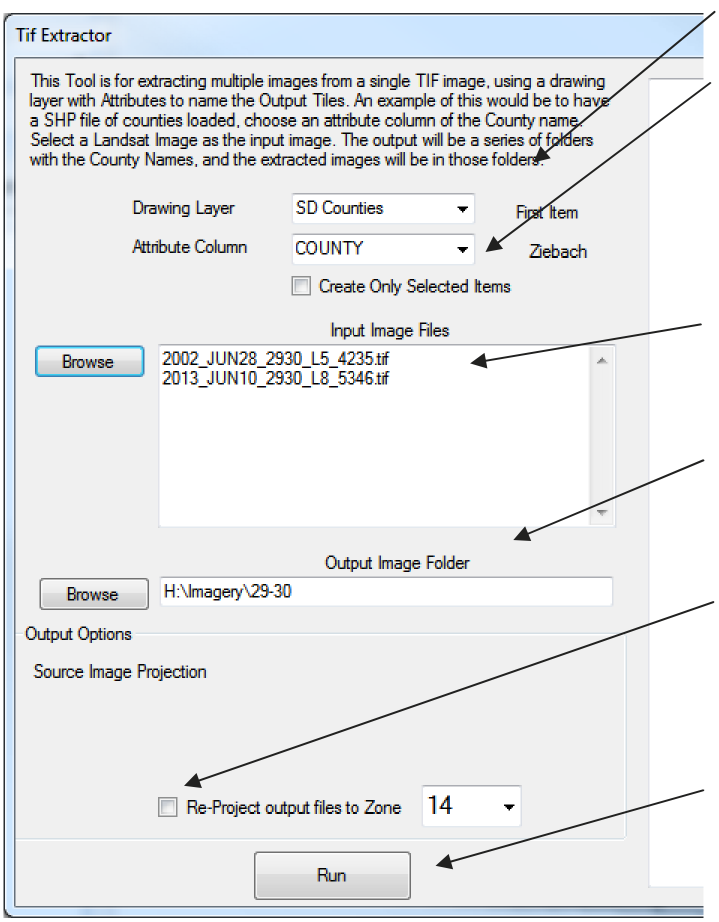
After all the images have had their coordinates updated, the tiff extractor utility may be used to clip them to a shape file. (This example will use a county shape file. Refer to downloading instructions to get it.)

1. Open the Map Window.
2. From the county data, select a shape file of the entire state containing all the counties in the state.



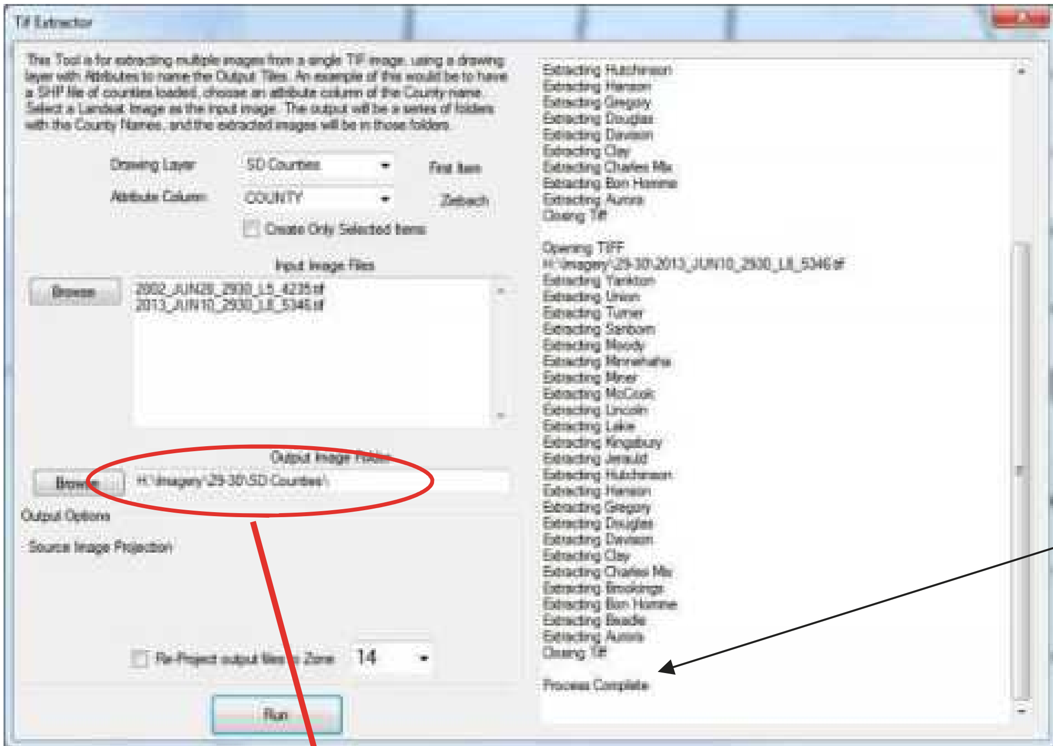


3. From the top of the screen, select "Process" and "Extract Tif by Drawing."
4. The tif extractor tool will open. This utility will clip the Landsat scene by the shape file that is loaded. Additionally, it will create a folder structure which is named by the database column that is selected.



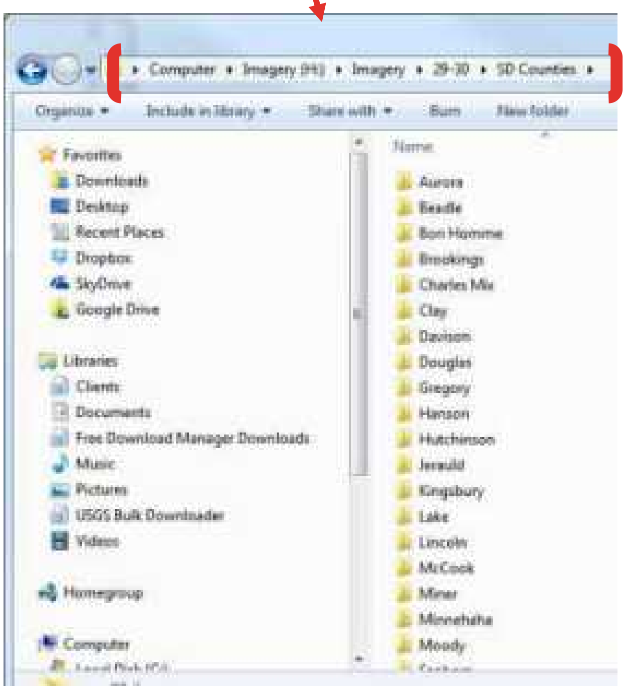
5. Select the drawing layer that will be used for clipping.
6. Select the database column to which the output folder(s) will be named. *(So with the attribute column selected as "COUNTY" it will create a folder for each county that the Landsat TIF covers and put it in that folder).*
7. Browse to the folder containing the images, select either one or multiple files. Click OK.
8. Browse to the Output Image Folder. *(This is where all the clipped images will be saved.)*
9. The desired output files may be re-projected to a different UTM zone. To do this, put a check by "Re-Project output files to Zone" and select the desired UTM zone.
10. Click "Run."
11. This utility will cycle through each image, create a folder for each county that it covers, and save it in the selected output directory. The progress will be indicated on the right side of the window.

Landsat Data Processing—Cutting Images by Shapefile



The extractor utility will cut an image out for each county that the Landsat scene covers and then creates and places them in a folder structure.

When all the files are finished being processed, "Process Complete" will be displayed at the bottom of the window.



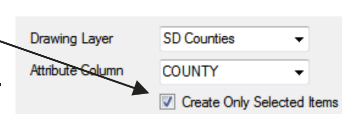
A file structure will appear in the directory that the output image folder was pointed at. Inside each of the counties will have a folder containing the extracted Landsat tiff images.

<u>Additional Notes:</u>

If only certain areas need to be processed, the function "Create Only Selected Items" can be used.

To utilize this function, the polygon(s) must first be selected before the Tif Extractor is opened.

1. With the polygon as the active layer, use the selection tools on the top toolbar.
2. Select the polygons to be extracted.
3. Open the Tif Extractor
4. Follow the process above and put a check in "Create Only Selected Items."

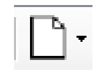


Landsat Data Processing—Cutting to Trade Territory

As stated earlier, this process can be used with any shape file, not just a county file. Often there is not just a single county that is covered in a trade territory. Therefore, a custom polygon can be made to cover a multi county region, or an irregular area.

For this example, a county file will be used as a guide to draw the custom polygon.

1. Turn on a county file so all the counties are visible.
2. From the bottom toolbar below the layer selection window, select "Create a New Layer From Template." Select Boundary.

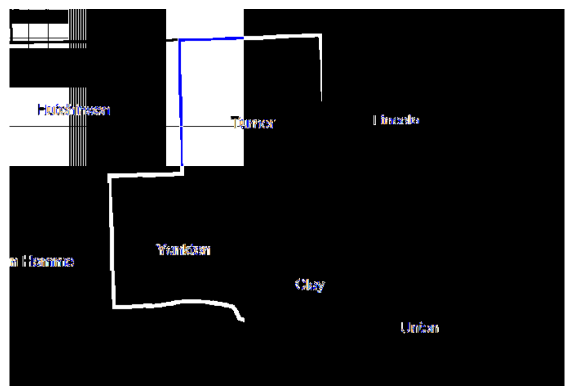


3. With the new boundary file checked on and set as the active layer, select "Draw a New Object" on the bottom toolbar.

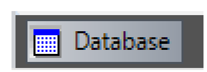
4. Using the county file as a guide, draw a polygon that covers the desired area.

Example: I am an agronomist that covers Clay, Yankton, Turner, and the South Half of Lincoln Counties in SE SD.

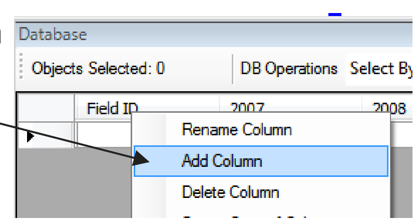
A polygon is created to represent the area covered. The Landsat scenes will be cut out to the specified area. (Represented in blue)



5. A column must be created and named in the database of the newly created shape file. This will tell the Tif Extractor how to name the output folder when the Landsat scenes are extracted.



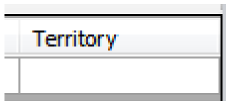
6. With the newly created shape file as the *Active Layer,* open the database tab on the bottom of the map window.
7. With the database open, right click on any column header and select "Add Column."



8. A column name will need to be entered, data type will be **Character**.
9. When the new column name is entered and data type is selected, click **Save**.

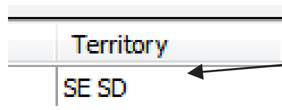
Landsat Data Processing—Cutting to Trade Territory

10. After clicking Save, a new column with the entered name will appear in the database.



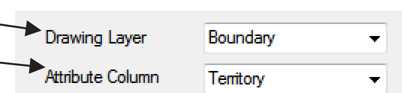
A name will have be entered in the column to define the output folder.

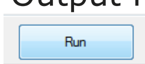
11. Double Click in the cell under the new column (Territory). This will allow for a name to be typed in.
12. Type the desired name, but keep it shorter than 15 characters. Hit the enter key on the keyboard and save the shape file.
13. A shape file will exist that:
    1. Defines a specified area.
    2. Has a character column added.
    3. A name will be in the character column under 15 characters. This will define the output folder.



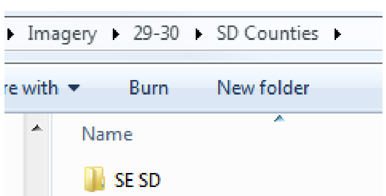
The output folder will be named SE SD.

14. With the new shape file turned on, open the Tif Extractor.
15. Select the new boundary as the **Drawing Layer** and the newly created column as the **Attribute Column**.
16. Browse to the Landsat scenes that will be extracted.
17. Browse to the Output Folder.
18. Select "Run"

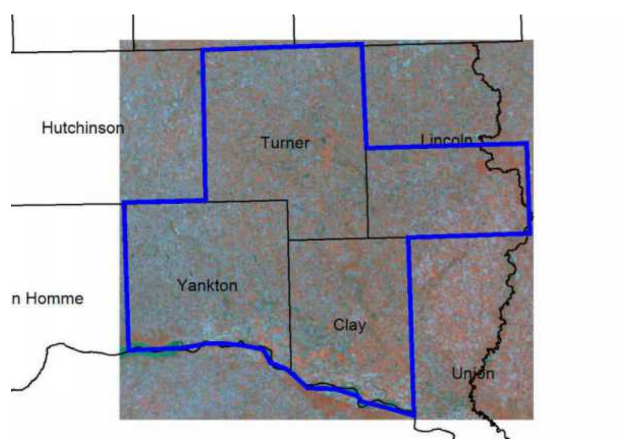




19. A folder will be created in the Output Folder with the name entered in the database column.



20. When the images are turned on, they will cover the specified area as long as it is part of the Landsat scene.



Using Satshot Website for Downloading Imagery

There are many Satellites and Imagery providers out there. GK is fortunate to have a working relationship with Agri ImaGIS or Satshot. Satshot has access to Landsat / RapidEye / Geovantage / Airbus / Planet Labs imagery sources.

To download Satshot data using GK—ADMS you must setup an account with Satshot first.

Please note the "Minimum Browser Requirements" below & follow the Satshot instructions for setting up a new account.

https://www.satshot.com/

Once you have your "Account" setup and "Credits" purchased you are done on the Satshot web page. At the bottom of the "My Account" page you will see your credits and a "Log Out" button.

- Log Out -

Now that you have Credits and an Account you can use the GK Satshot interface.

Using Satshot Website for Downloading Imagery

There are three functions for accessing Satshot

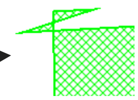
Step 1.—Uploading a new boundary to Sateshot

Step 2.—Logging into the site

Step 3.—Finding an image and downloading.

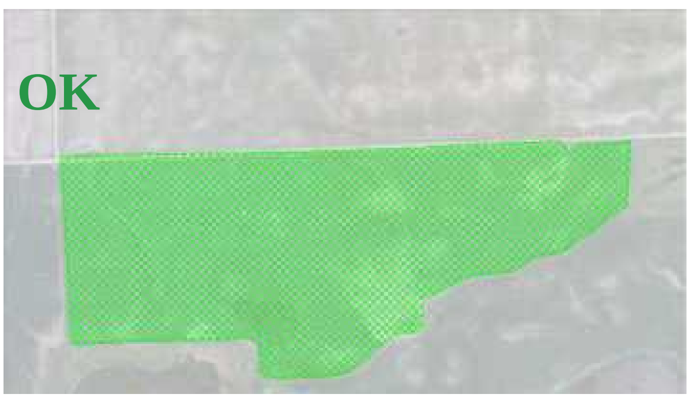
Step 1—Uploading Boundary

- Create your boundary as you normally would in ADMS.
    - You can only upload simple boundaries to Satshot. NOT poly-polygons.
    - Boundaries cannot have "knots" in them This is a "Knot"

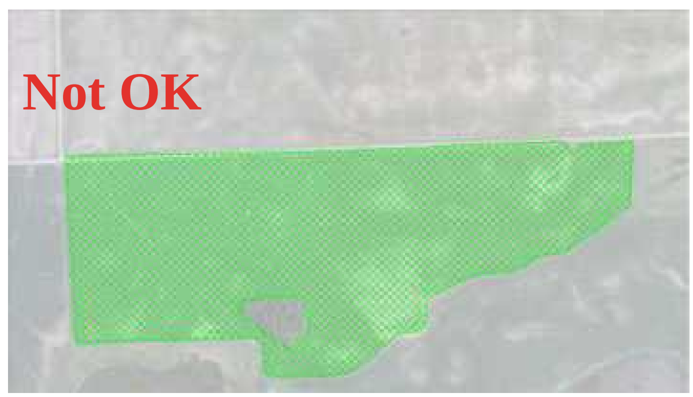


- If your boundary is a Poly-Polygon, see the section on "Decomposing Poly-Polygons"

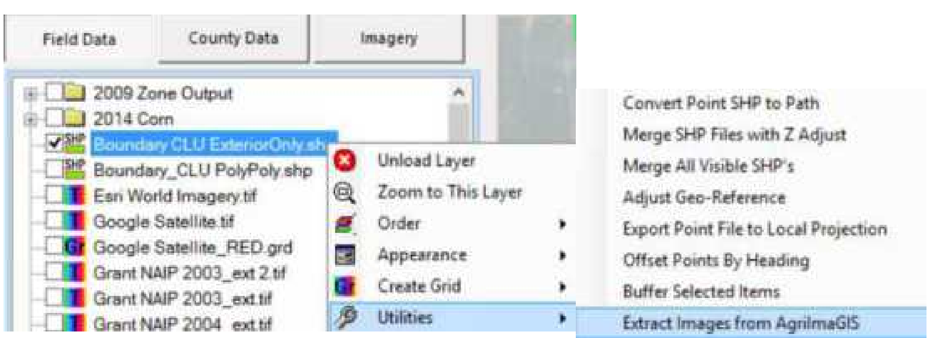
Simple Polygon



Poly-Polygon



- Right Click on your simple "Boundary.shp" name.
    - Select "Utilities" and "Extract Images from AgriImaGIS"



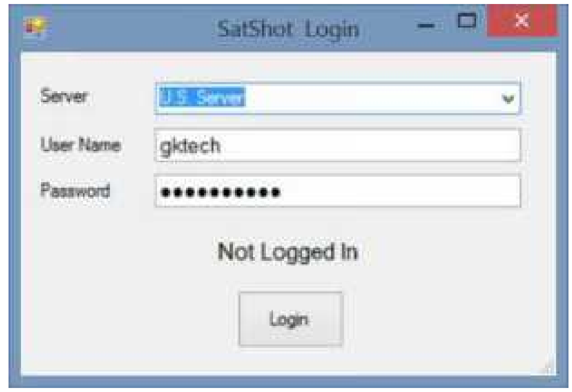
This will bring you the Satshot login page without going through the "Satshot" button

Note: you can only have 1 boundary per field for all projects.

Using Satshot Website for Downloading Imagery

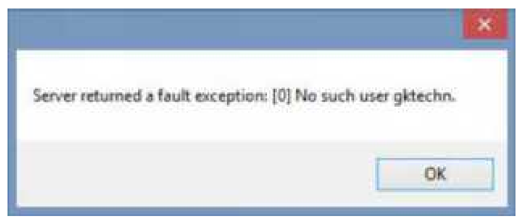
Step 2—Logging into Satshot Interface

- From the ADMS startup page click on "SatShot Interface" button.
  - or you will get to this screen by "Uploading a Boundary"



- Choose your "Server"
  - US Sever or Canada Server
- Type in "User Name"
- Type in "Password"
- This data was setup on the Satshot website.

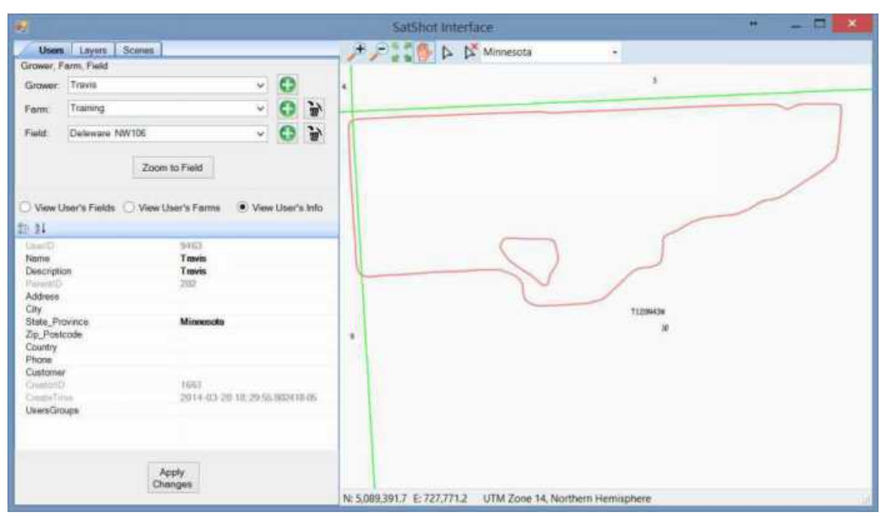
- If you type in an INVALID User Name =



- If you type in an INVALID Password =

Step 3—Finding Images & Downloading

- Upon opening into the ADMS—"SatShot Interface" the Map Window area will automatically zoom to the "Field Boundary".

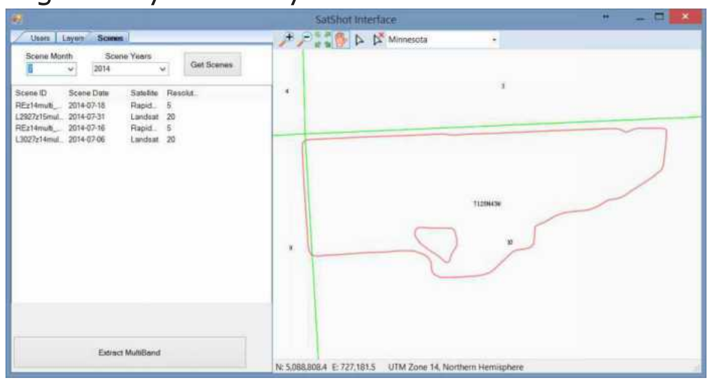


- Only "Field Names" that have "Field Boundaries" will show up in the Grower/Farm/Field list.
- When choosing a new "Field Name" the software will automatically zoom to the Boundary.

Using Satshot Website for Downloading Imagery

Step 3—Finding Images & Downloading

- If you want to choose or turn on other state or regional layers. Choose the "Layers" tab
  - GK does not suggest turning on any more layers.



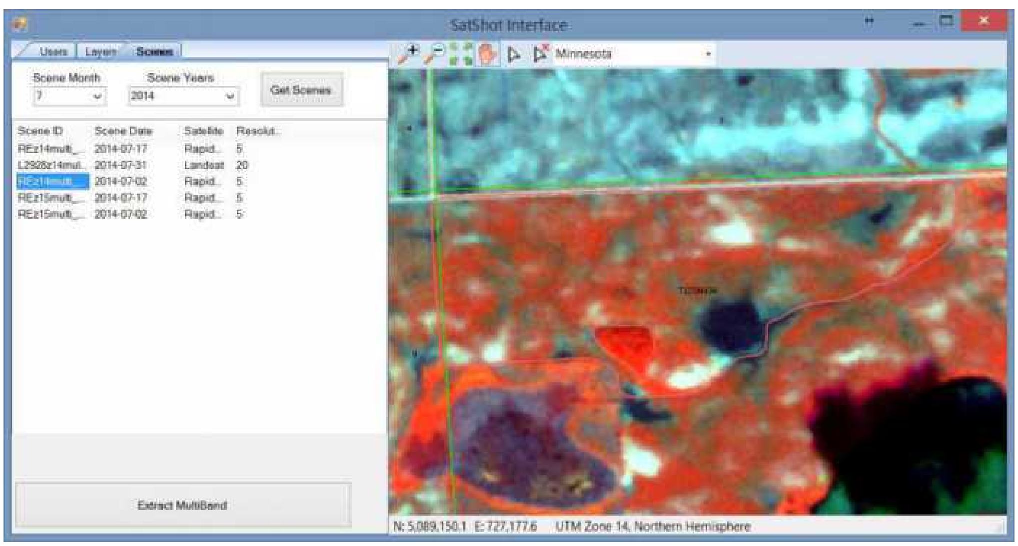
- Go to the "Scenes" tab
- Choose the "Month" & "Year"

  - Click "Get Scenes"

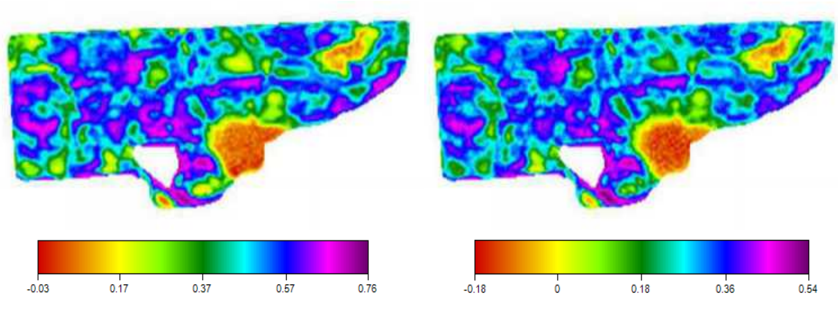
- Click on the image you want to see.

  -This may be slow-

Click "Extract MultiBand". Your images will go back to your "Field" folder and will be placed in an "Images" folder.



Examples of extractions. These extractions will be in .grd format.



It is suggested to leave the "SatShot Interface" window open as long as you are working on extractions. When you are finished, return to the "Map Window" leaving the "SatShot Interface" open.

Downloading LiDAR—International Water Institute

One source for importing LiDAR data for the “Red River Valley of the North” is the International Water Institute.

NOTE : All of this LiDAR data is in UTM 14

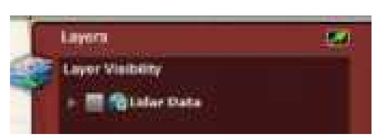
http://gis.rrbdin.org/lidardownload/index.html

1. To select areas for download—a few methods listed below.

    1. Use the zooming panning tools to find you location
    2. Use the “Address or Place” line and type in a city name.
    3. Select by “County” by clicking on the “Red Flag” button
    4. Select by “Township and Range” on the “layered image” button

2. Once you get close to the area you want to be in, there should be a “Green” haze. This means there is data available!! To turn off the “Green” mask, click on  the “Layers” Button.

3. Remove the “Check” from the “Lidar Data” item.



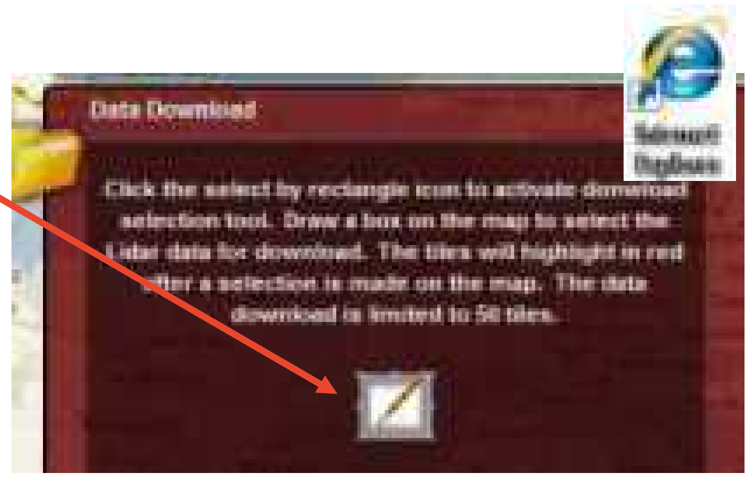
Downloading LiDAR—International Water Institute

4. Get zoomed to the area you want to download.

5. Click on the "Data Download" Button

   Draw a box around the area for Downloading (make sure you cover all the area you want to work with)

Take note: you can only download 50 tiles in one download.

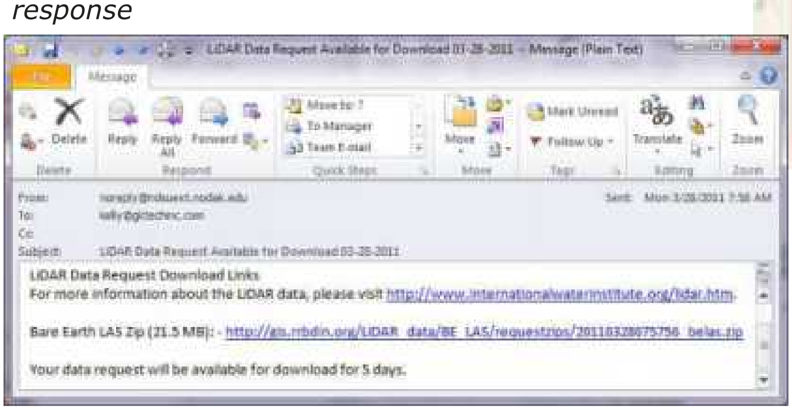


6. Once you have defined your area for download, a "Data Download" window will open.

7. ADMS can use either the "Bare Earth LAS Files" or the "Raw LAS Files" (we recommend the Bare Earth files)

Take note: the Raw LAS file has more data like building, high-med-low vegetation, noise and ground hits. Vs Bare earth just having ground hits only.

Finally enter a valid email address. The site will bundle all the tiles into one download link and send you an email to download.
Note: This can take 1 min up to 1 day for email response

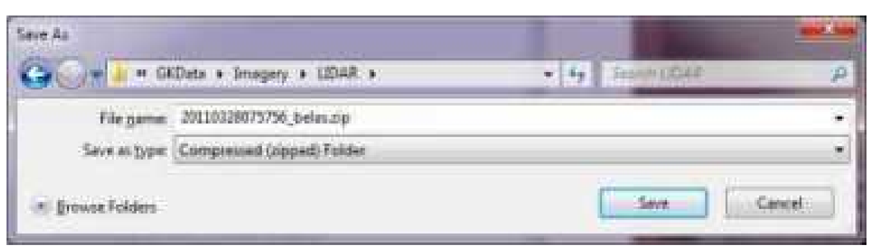


Click "Save" when the download window opens.

In saving the files, we suggest you save the files back to your C:/GKData/Imagery/LIDAR folder. It is recommended to save all your files back to a "LIDAR" folder to keep things clear. If you are working with more than a couple counties of data, you may want to create "County" folders within the LIDAR folder.

Once saved there, the data must be UNZIPPED. We suggest cleaning up files so you have all the xxxx.las files in a "LIDAR" or "County" folder.

See Processing LIDAR



Downloading LiDAR For North Dakota—Ordering

Requesting Data

LiDAR data can be downloaded for a large part of North Dakota from the ND LiDAR Dissemination Mapservice.
To get started first navigate to their website: **http://lidar.swc.nd.gov/**

For the downloading process it is recommended to use Microsoft Internet Explorer.

Once on the website it should look similar to the image below:

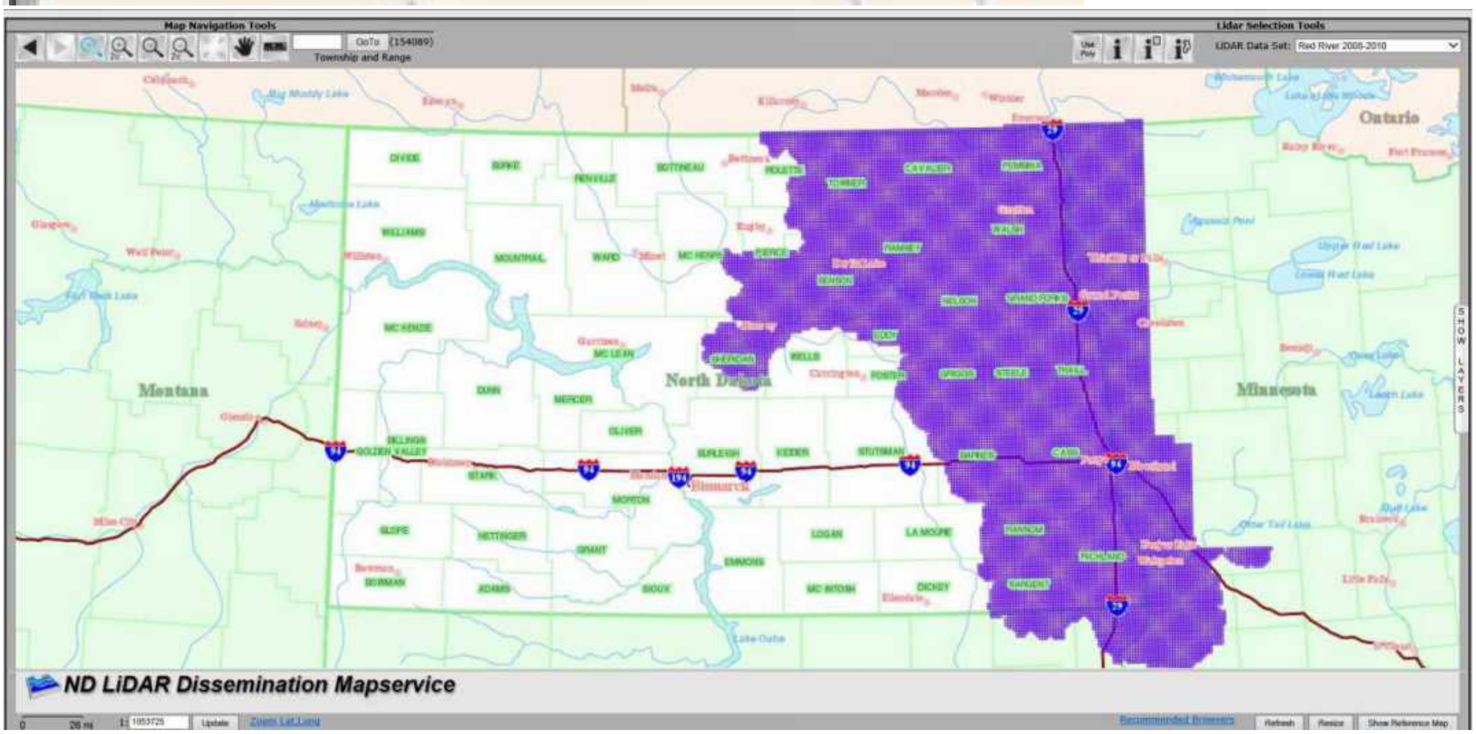
Once on the website there are several steps to request LiDAR data to be downloaded.

1. Select the LiDAR Data Set to be downloaded. These options are located in the top right corner of the website. This example will use Red River 2008-2010.
2. After selecting the data set a window will appear with a disclaimer that must be accepted to download the data. Read the disclaimer and if you agree click "I accept" 

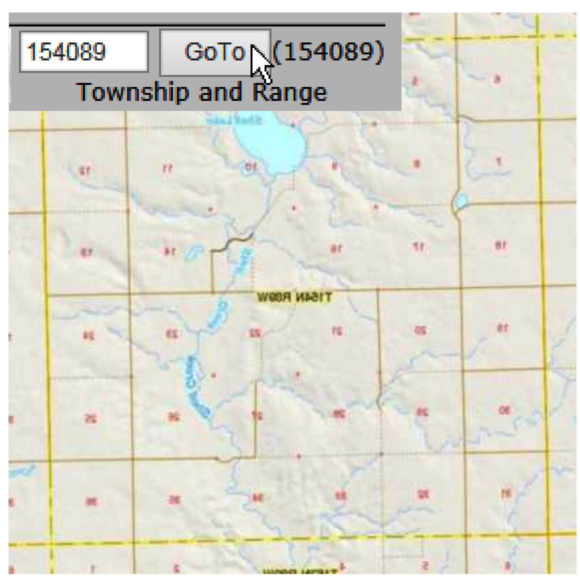
Downloading LiDAR For North Dakota—Ordering

3. After accepting the disclaimer, the data outlines will appear on the map. This is a good indicator of where the data is available and if the LiDAR Data Set has to be adjusted.

4. Using the navigation tools on the top left corner of the website locate the area to download the LiDAR from. To identify what each of the tools do, mouse over them and it will display what each one does.

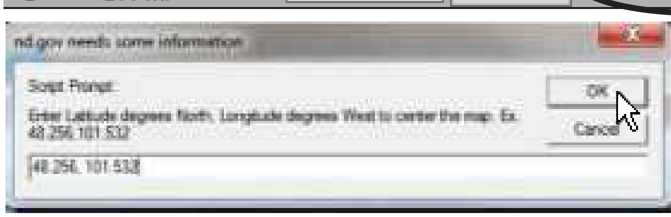


5. If the township and range is known it can be entered in the box to the right of the navigation tools and by clicking "GoTo" will zoom into that area.



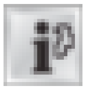
*Note: After zooming in the Township and Section ID's will appear on the map to help identify an area.

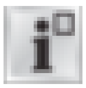
6. If the Lat, and Lon are known for a point they may also be entered in by going to the bottom of the page.

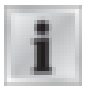


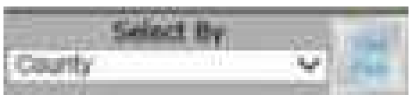
Downloading LiDAR For North Dakota—Ordering

7. After zooming in the area has to be selected using the LiDAR selection tools on the top right corner of the website.

 Use to select an area by a hand drawn polygon.

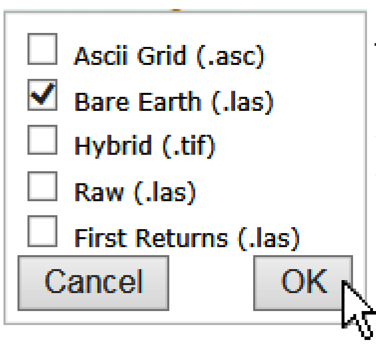
 Use to select an area by a square.

 Use to get information about the active layer.



Use Poly if a specific area needs to be downloaded. This may be used to download individual counties, townships, or sections at a time.

8. When the area is selected to download, another window will appear asking to select the type of file to download.



To utilize this within ADMS:

- Select the “Bare Earth (.las)” files
- Click “OK.”

After clicking “OK” a window will appear with each of the tiles to download.
They can be downloaded individually by clicking Get or using an ftp client such as FileZilla.
The number of links will changed depending on the size of the selection.

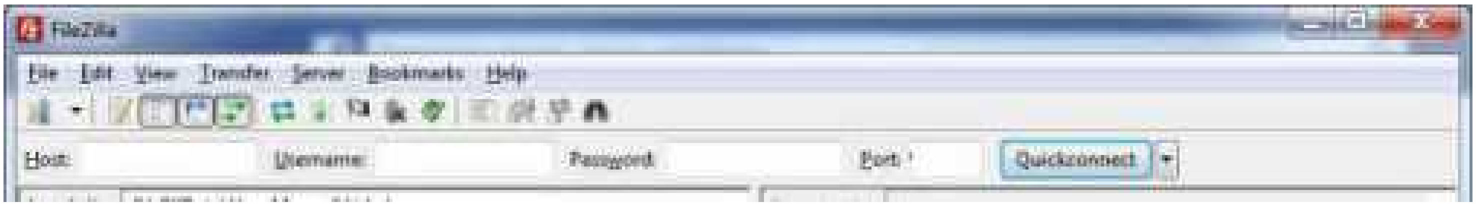
If a large number of tiles need to be downloaded it is recommended to connect to the ftp site.

Grid Name	Bare Earth
06045372	Get
06065370	Get
06065372	Get
06045370	Get

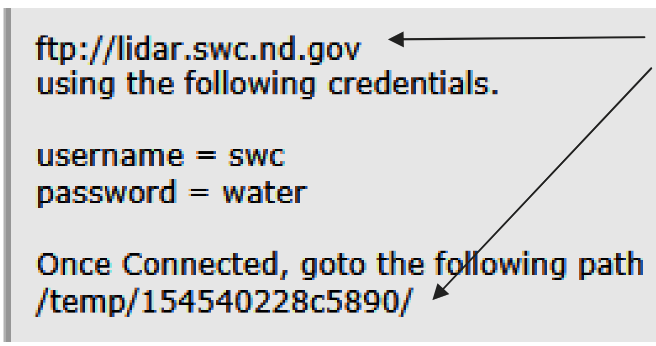
Downloading LiDAR For North Dakota—FileZilla

FileZilla is a free FTP client. This will allow for a bulk download of files from the FTP site. This a recommended software, but others may be used.

1. Follow the previous steps to order/select the data to download.
2. Download a copy of FileZilla. It available at: https://filezilla-project.org/
3. After the download and installation of FileZilla open up the software.
4. To Connect to the ND site a Host, Username, and Password are needed.



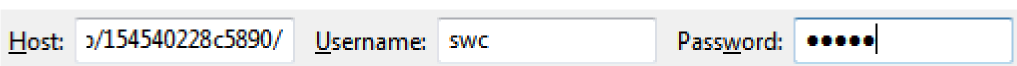
5. The Host, Username, and Password are located on the information panel after the data is selected.



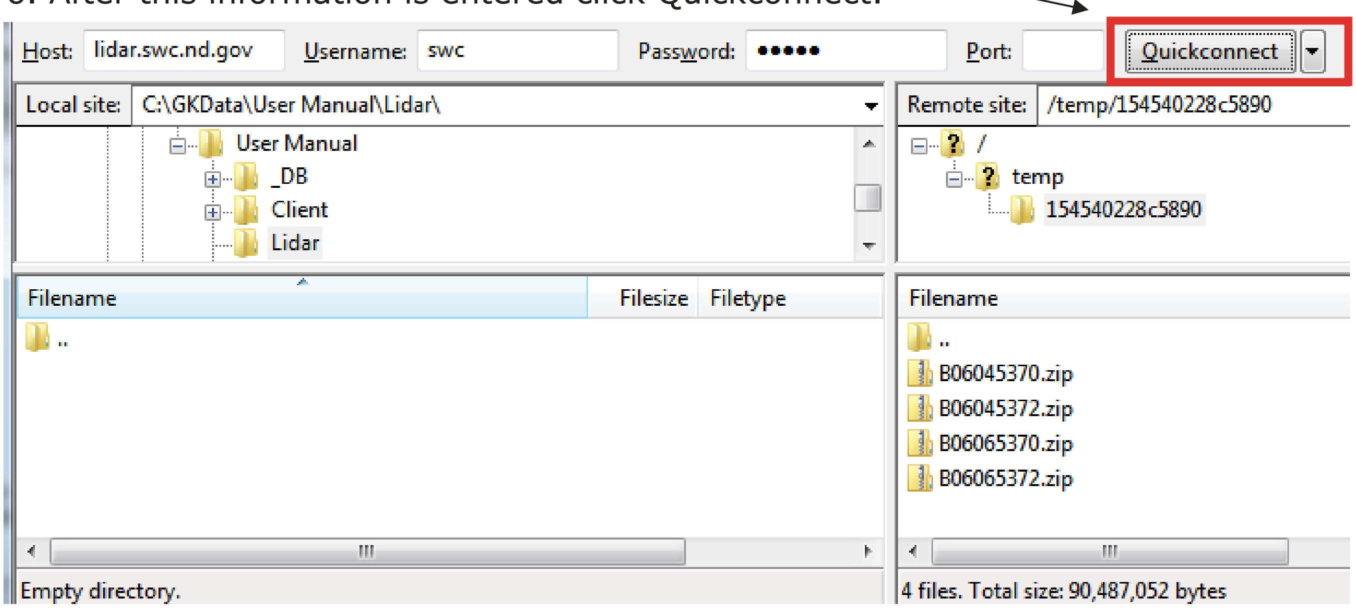
The Host will be ftp://lidar.swc.nd.gov followed by /temp/154540228c5890/

These will have to be copied and pasted separately into FileZilla. The last part of the address will change for every order.

The username = swc and password = water. These will not change.

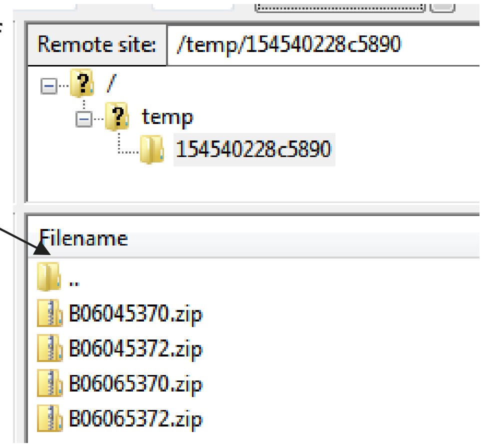


6. After this information is entered click Quickconnect.

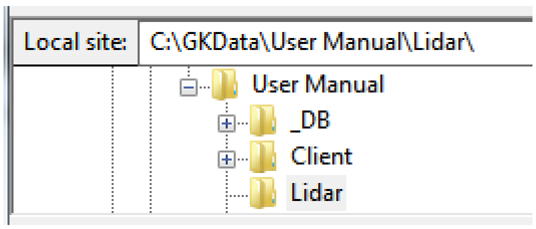


Downloading LiDAR For North Dakota—FileZilla

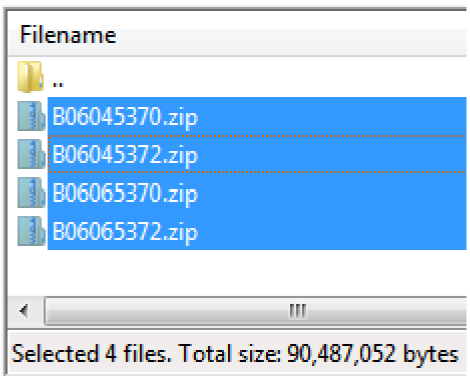
After connecting the files should be visible on the right side of the screen and will show up as *.zip files.



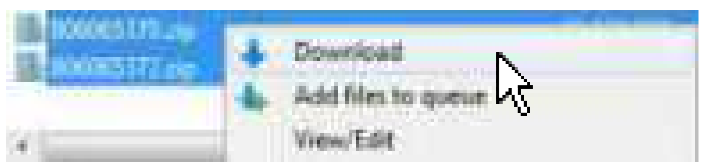
7. Using the Local site window on the left browse to the location where the *.zip files will be saved to.



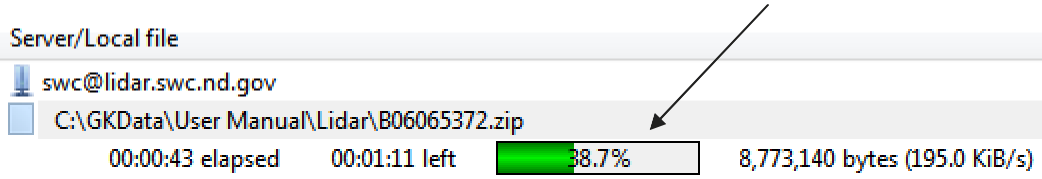
8. After connecting to the remote site and browsing to the location on the local computer select the *.zip LiDAR files to download.



9. After the files are selected:
Right Click—Select "Download"



10. The files will start to transfer and the progress can be viewed on the bottom window.



***It is recommended that before proceeding install 7-zip on your computer.**
http://www.7-zip.org/
11. After the files have finished downloading browse to the location where they were saved.
12. Select all of them.
13. Right Click and Go 7-zip>Extract Here (7-zip must be installed for this to work).
14. The *.las files will now show up in the same folder and can be imported into ADMS as elevation data. After extraction the *.zip files may be deleted to save space.

***For detailed instructions on FileZilla visit:**
https://wiki.filezilla-project.org/Tutorial

Downloading LiDAR—MN DNR—FTP: Site

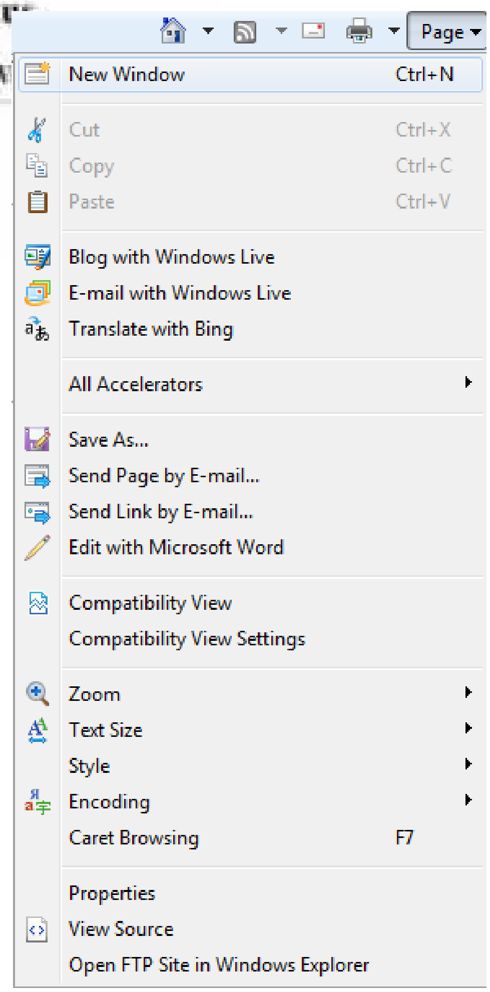
On this site, you will be downloading right from the Minnesota DNR FTP website. This site contains LiDAR for Eastern & Central & Southern Minnesota (counties that are not in the RED RIVER BASIN). We strongly suggest using Internet Explorer for navigating this site, due to the fact that other browsers can corrupt the “Unzipping Tools”. On this site, you will be downloading “LAZ” files (Zipped up .las files). These files can not be unzipped by standard zipping tools.

Note: All of the data on this site is in UTM 15

Starting Point for Downloading—

ftp://ftp.lmic.state.mn.us/pub/data/elevation/lidar

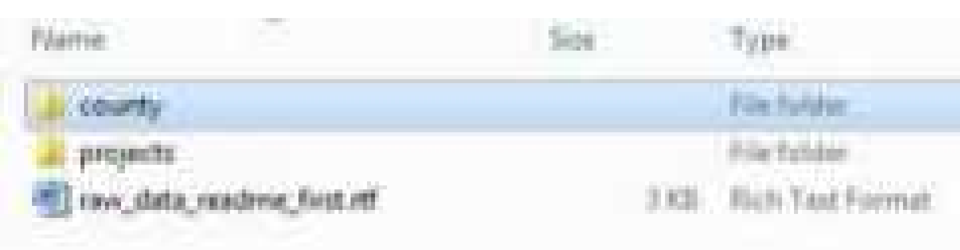
When you first enter the site, it will look like the window below.



If you prefer to navigate like you are in Windows “File Explorer”

Using the “Command Bar” go to “Page” & “Open FTP Site in Windows Explorer”

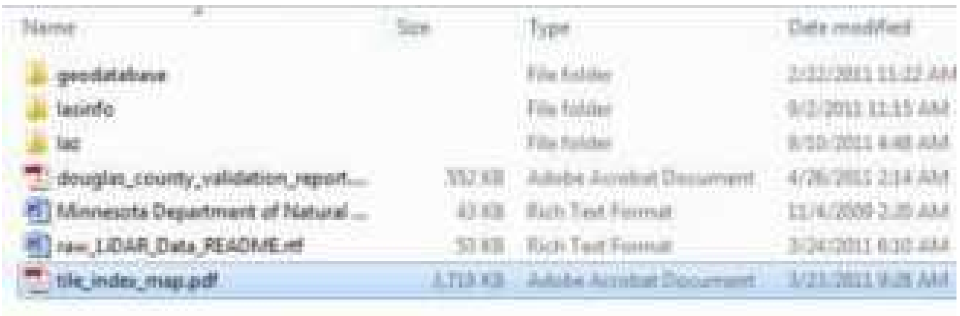
Using the “Menu” bar” go to “View” & “Open FTP Site in Windows Explorer”



Downloading LiDAR—MN DNR—FTP: Site

You are now ready to “Download” data from the MN DNR LiDAR Site.

1. Click on the “county” folder (directory)
2. Click on the “county name” folder (directory) you want to download.
3. Click on the “tile_index_map.pdf”.



4. Once the PDF opens. “SAVE” this back to your C:/GKData/Imagery/LIDAR/County Name folder. This will require you to Create some new folders (Douglas in this example)

5. Browse / navigate this map to find your “rough field location”
6. Take note of the “Tile Numbers” that it will take to cover the area you want to download.
   Suggest writing these ##’s down on a piece of paper.
   — For our example here—Tile #’s 2726-32-12 & 2726-32-13
7. Go back to your “FTP” File Explorer Window & Open the “laz” folder (directory)
8. Choose (highlight) the Tile # you want to download & “Right Click” & “Copy To Folder”
   - Note: Save these back to your C:/GKData/Imagery/LiDAR/County Name folder (Douglas)
   - Download all the “tile #’s” you need for your project before going to the next step.

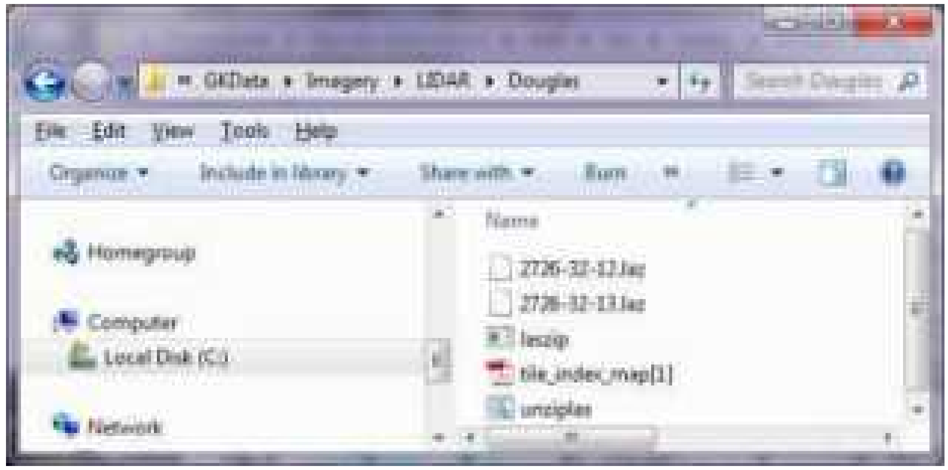
Downloading LiDAR—MN DNR—FTP: Site

9. Choose (highlight) the "laszip.exe" & "unziplas.bat" files & Right Click" & "Copy To Folder"
   - Note: Save these back to your C:/GKData/Imagery/LiDAR/County Name folder (Douglas)
   -IMPORTANT!!!! These files have to be in the same "Folder" as the LAZ files!!!!

10. Double Click on the "unziplas.bat" file

11. A "DOS" window will open up like below. ***DO NOT CLOSE IT***. It will close automatically.

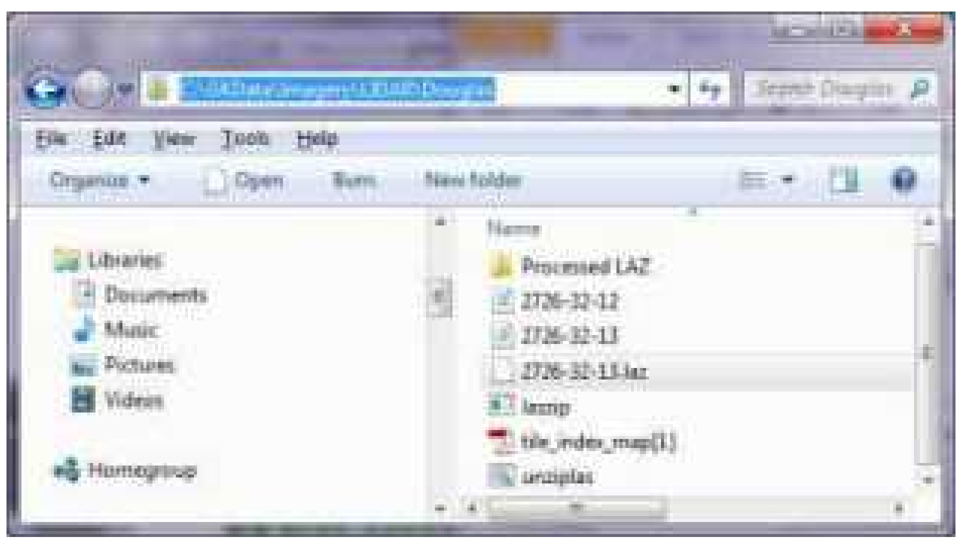
Note: It takes up to 30 seconds per LAZ file, so be patient.



12. When finished, you will have a folder that looks something like this.

13. Suggest creating new folder named "Processed LAZ" and moving all your Processed LAZ file here so you don't have the "laz extractor" re-processing these files.

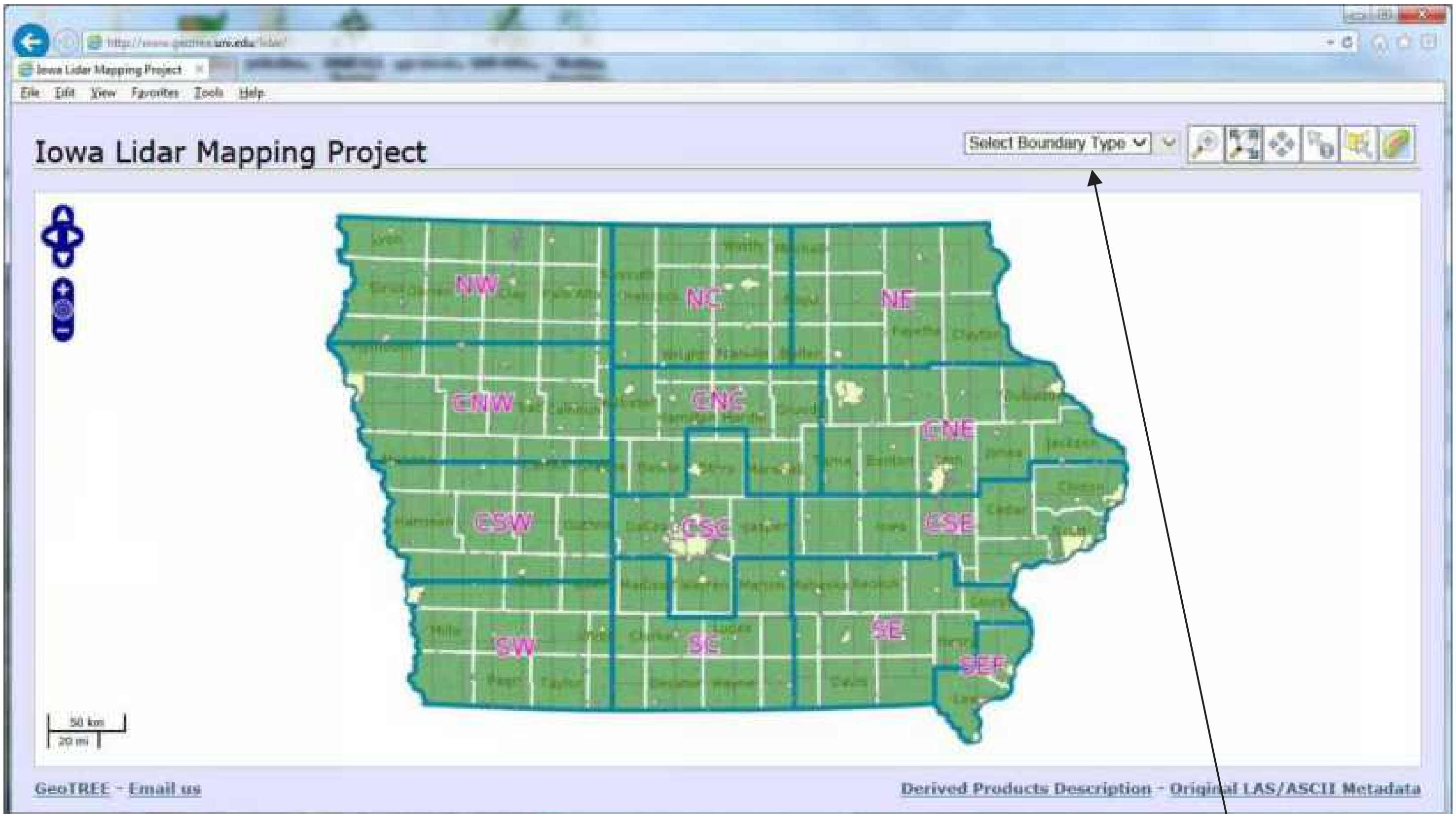
14. Go back to the "Processing Lidar" section of the user manual.



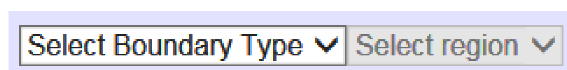
Downloading LiDAR—Iowa LiDAR Mapping Project

A source for importing LIDAR data in Iowa is the "Iowa Lidar Mapping Project".

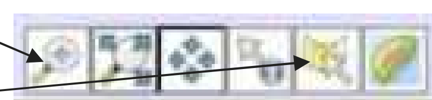
http://www.geotree.uni.edu/lidar/
Make sure there is no pop-up blocker on and they are allowed for this site.



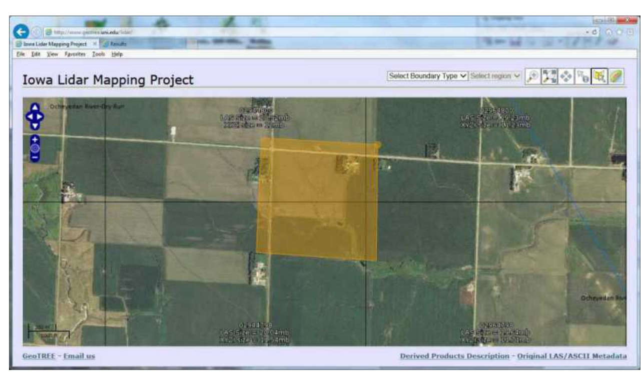
There are several ways to select an area to download.



1. Select an area by boundary type (e.g. counties, cities, watersheds).
2. Use the zooming tools on the top toolbar to get zoomed into the area to download.



- After getting zoomed into the area to download.
- Draw a polygon to select LiDAR tiles to download. (left click to drop points and double click to close the polygon.
- After drawing a polygon a popup will appear in another window with the download links and instructions on how to download the data. See next page.



Downloading LiDAR—Iowa LiDAR Mapping Project

Once the new window opens.

Note: you do need "7-Zip" for unzipping files.

If you are downloading a lot of files, you may want to use the "Free Download Manager". Do NOT install the "Software Informer" or other additional installs.

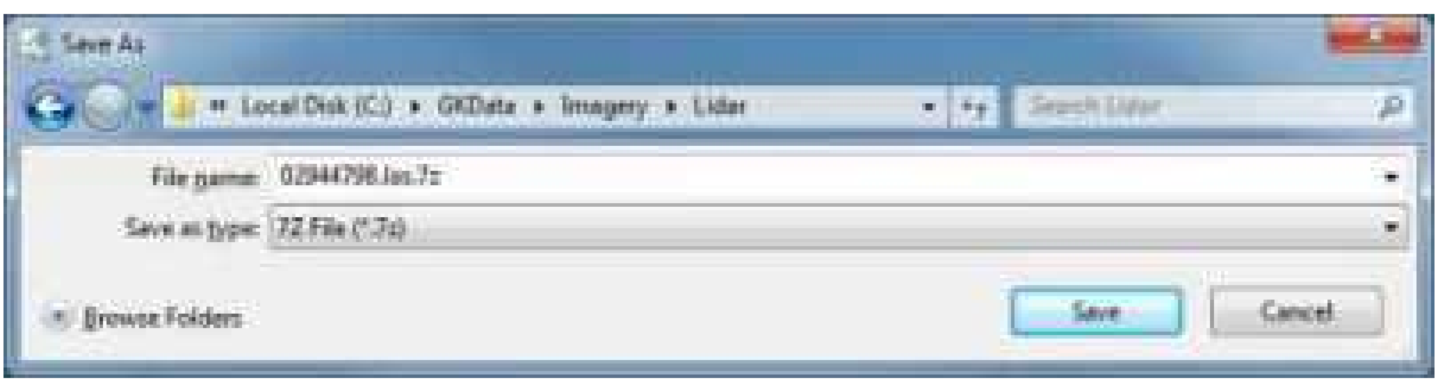
5. Select /Click on "LiDAR download"

6. Click on the "LAS Links" to download.

7. Click "Save" when the download window opens.

In saving the files, we suggest you save the files back to your C:/GKData/Imagery/LiDAR folder. It is recommended to save all your files back to a "LIDAR" folder to keep things clear. If you are working with more than a couple counties of data, you may want to create "County" folders within the LiDAR folder.

Once saved there, the data must be UNZIPPED. Suggest cleaning up files so you have all the xxxx.las files in the "LiDAR" or "County" folder.



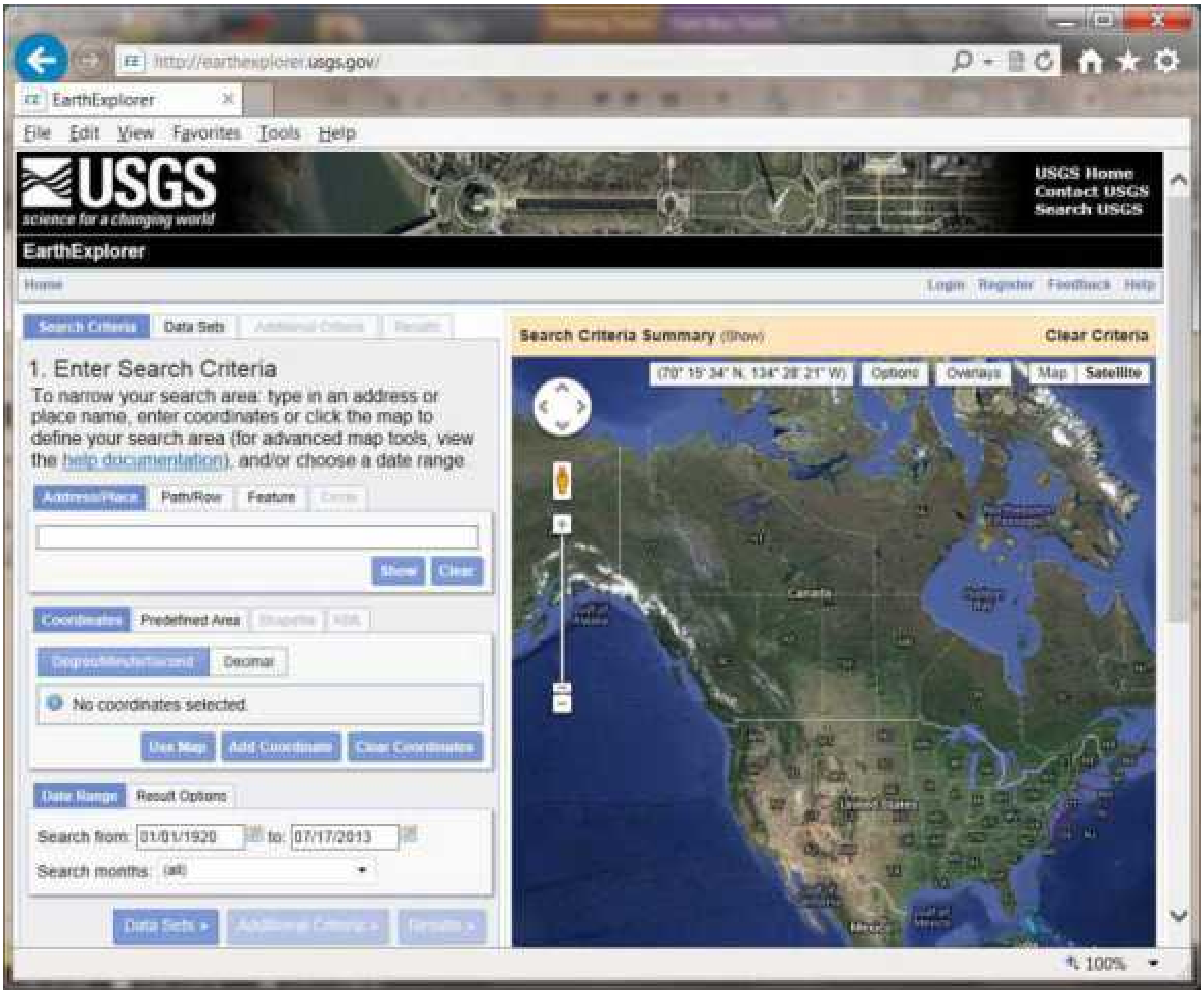
Downloading & Processing USGS LiDAR—Earth Explorer

The USGS is a source for downloading many different GIS data sources.

Earth Explorer site has many options, these instructions will walk you through how to find and download LIDAR data.

NOTE: We at GK Technology prefer to use the USGS—GLOVIS for doing satellite imagery downloads and the Earth Explorer for LIDAR. You can download the satellite imagery on the Earth Explorer also, but you can NOT download LIDAR from GLOVIS.

To get started go to **http://earthexplorer.usgs.gov**



Downloading & Processing USGS LiDAR—Earth Explorer

Navigation is done by either:

Typing in an address (type in City, State) & "Zoom" & "Pan" to location

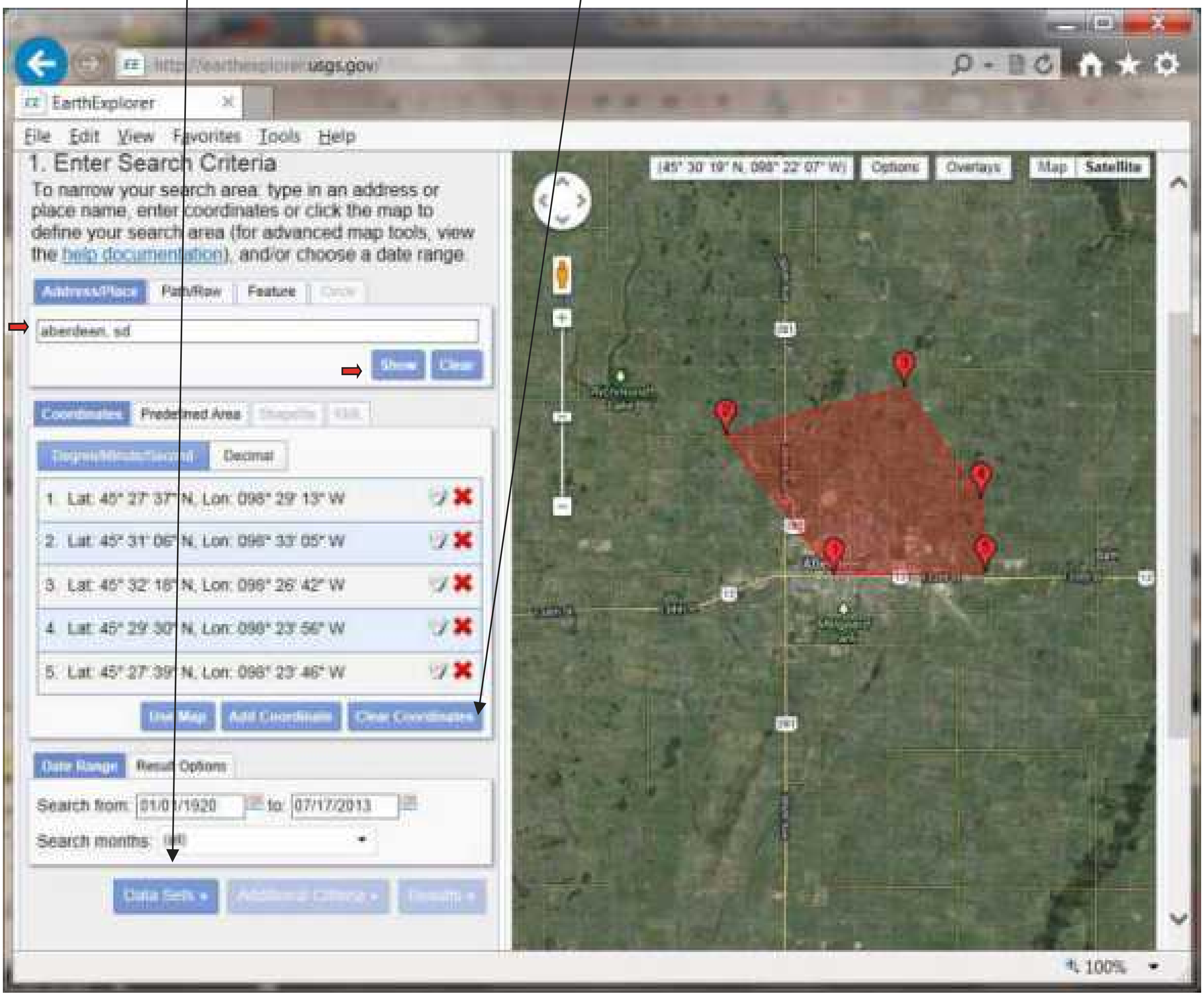
OR

Use the "Zoom" & "Pan"

Once your location is found, you must "Define" your area by simply "left clicking" on the map. If you typed an address, you can move the "Red" pin marker "1" by "left click—hold drag" and move it's location. Or "Clear Coordinates" and start fresh.

Once the area is "Defined",

Click "Data Sets"



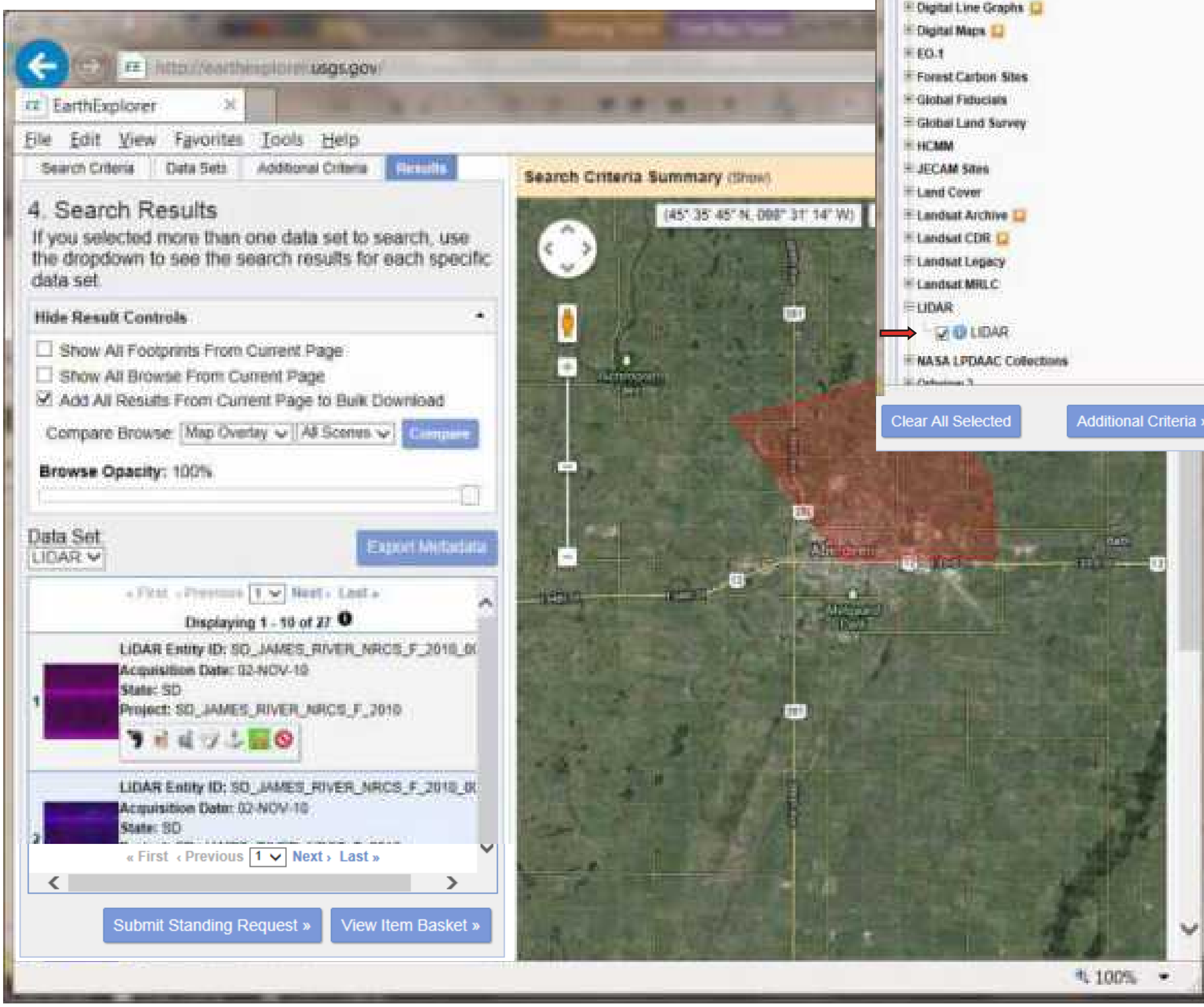
Downloading & Processing USGS LiDAR—Earth Explorer

From the list of options—"Check" the LiDAR box

Click on the "Results" button at the bottom of the page.

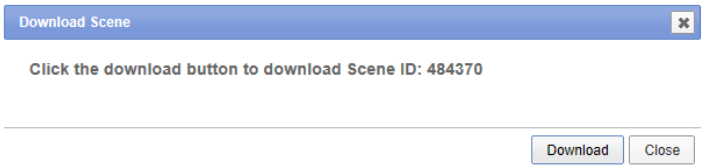
This will bring you to "4. Search Results"
Click open the "Show Results Controls" at the top
Suggest—Check the "Add All Results-Bulk Download"
This step must be done on all pages of results

Click the "View Item Basket" button
OR
Click the "Download" button & download 1 by 1



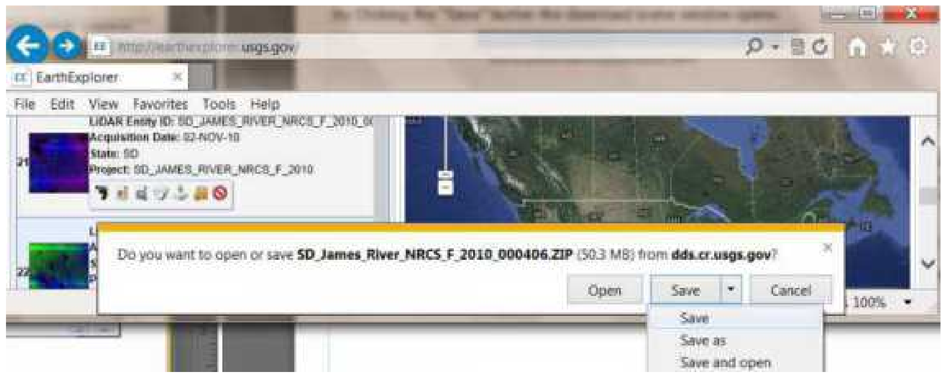
Downloading & Processing USGS LiDAR—Earth Explorer

By Clicking the “Save” button, the download scene window opens.

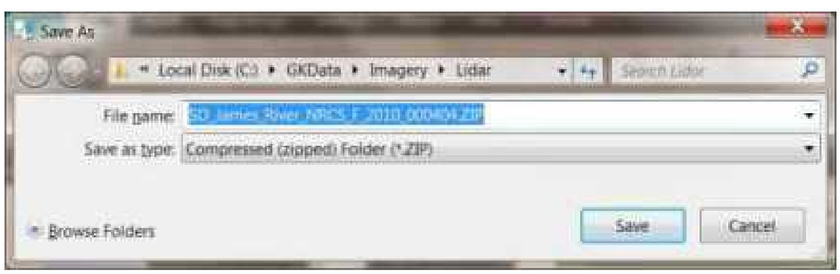


Click Download

Click “Save” & “Save As”



In saving the files, we suggest you save the files back to your C:/GKData/Imagery/LiDAR folder. It is recommended to save all your files back to a “LiDAR” folder to keep things clear. If you are working with more than a couple counties of data, you may want to create “County” folders within the LiDAR folder.



Once saved there, the data must be UNZIPPED. We suggest cleaning up files so you have all the xxxx.las files in a “LiDAR” or “County” folder. Once unzipped, all the .las files should be in one folder, not many separate folders.

See Processing LIDAR

For additional and more detailed instruction visit the Earth Explorer tutorial by clicking “Help” in the right corner of the screen.
Or you can visit the page directly at:

https://lta.cr.usgs.gov/ee_help

LiDAR—LAS Catalog Creation (LAS & LAZ)

LiDAR data is some very powerful & useful data. This data can be hard to index and catalog what data you have and what you are missing because files need to be processed into ADMS or you need to know "Tile #s" you are looking for.

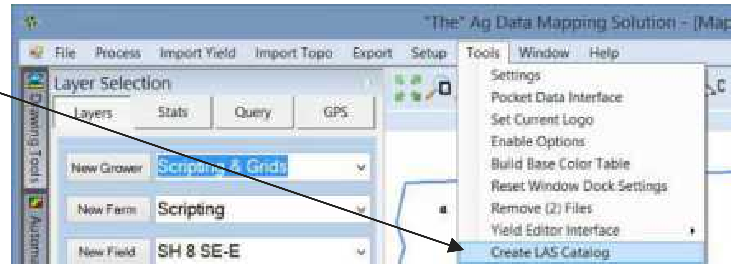
The "Create LAS Catalog" tool with create a SHP polygon around all the Lidar Tiles (LAS or LAZ) in a folder and label them based on the File Name.

Using LAS Catalog Tool

Go to "Tools" and "Create LAS Catalog"

Ex.—shows a field in Norman County MN.

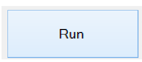
Question—What area do I have for Lidar?

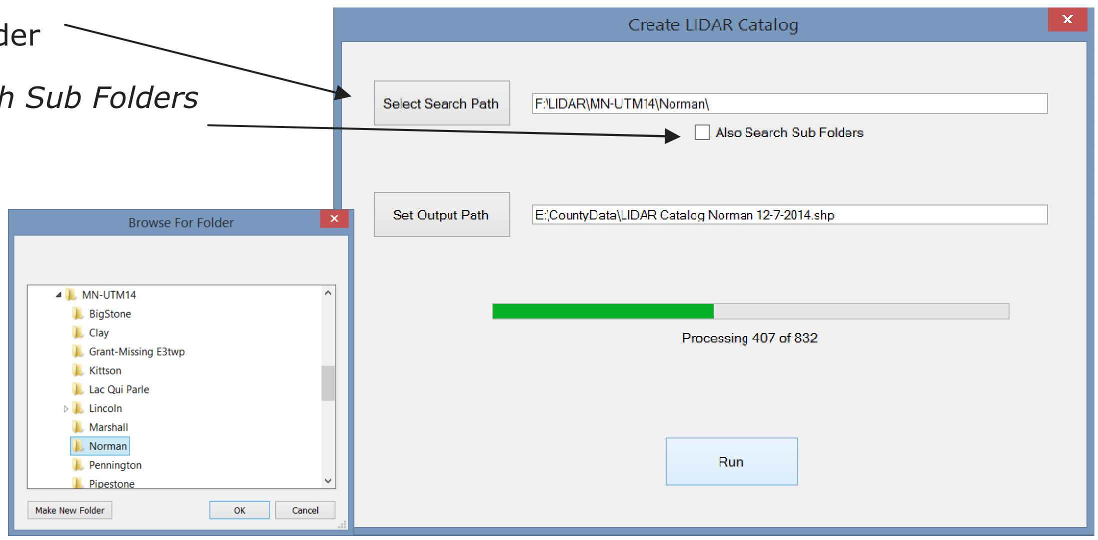


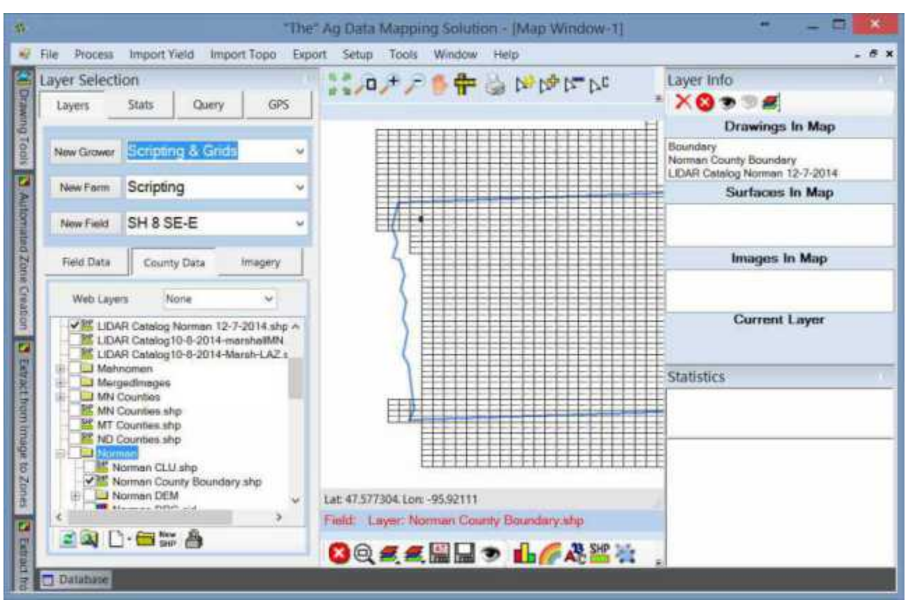
Set your Lidar Source Folder

Note: you can Search Sub Folders

Click "Run"







Your output location will default into your "County Data" folder.

Note: if you name or re-name the "Output" you must keep the .shp extension.

The SHP Catalog will be in your "County Data" folder

You may want turn on "Labels" for the SHP file using the ABC button.

My Notes

Glossary

GIS— Acronym for *Geographic Information System* is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.

Projection—A method by which the curved three-dimensional surface of the earth is portrayed on a two-dimensional flat surface. This generally requires a mathematical transformation of the earth's lines of longitude and latitude onto a plane. Every map projection distorts distance, area, shape, direction, or some combination thereof.

Spherical Coordinate System—A coordinate system that uses positions of latitude and longitude to define locations of points on the surface of the earth.

Cartesian Coordinate System—Defined as a flat coordinate system placed on the surface of the Earth. In some projections it's not flat in the sense that it follows the earth's curvature in one direction and has a known scale of error in the other direction relative to the distance of the origin. The most well-known coordinate system is the Universal Transvers Mercator (UTM). It is very easy to work with, fairly accurate over small distances making measurements such as length, angle and area very straightforward.

UTM—Acronym for *universal transverse Mercator*. A projected coordinate system that divides the world into 60 north and south zones, 6 degrees wide. This is what everything is projected in within the software. Being in the correct UTM zone is critical to ensure the location is accurate.

Datum— Point, line, or surface used as a reference. The datum defines an ellipsoid and through set points on the ground they are related to points on the ellipsoid, the center of the earth is defined. There are many different datums used for measurements locally and worldwide. Common datums are WGS84 and NAD83.

NAD 83— *North American Datum of 1983*— Datum defined to remain consistent over the years for the North American Continental Plate.

WGS 84— Most well known datum. Gives a good approximation of points over the entire world and in theory remain consistent over time.

Latitude— The angular distance, usually measured in degrees north or south of the equator. Lines of latitude are also referred to as parallels.

Longitude—The angular distance, usually expressed in degrees, minutes, and seconds, of the location of a point on the earth's surface east or west of an arbitrarily defined meridian (usually the Greenwich prime meridian). All lines of longitude are great circles that intersect the equator and pass through the North and South Poles.

Glossary

Vector—A coordinate-based data model that represents geographic features as points, lines, and polygons. Each point feature is represented as a single coordinate pair, while line and polygon features are represented as ordered lists of vertices. Attributes are associated with each vector feature, as opposed to a raster data model, which associates attributes with grid cells.

Point— Zero dimensional and do not have a volume, area, or length. Points have many uses, they can be yield, mark areas in the field, define elevation along with many other types of data.

Line— A path that is connected by at least two vertices. However, multiple consecutive vertices can be used to create a curved line.

Polygon— A combination of multiple line segments that represent a closed shape. Polygons are vector data and can be grids or boundaries.

Raster— This is how images are displayed within the software. Where each pixel has one or multiple values associated with it. This gives increased accuracy and more detail when creating application maps. It is a spatial data model that defines space as an array of equally sized cells arranged in rows and columns, and composed of single or multiple bands. Each cell contains an attribute value and location coordinates. Unlike a vector structure, which stores coordinates explicitly, raster coordinates are contained in the ordering of the matrix. Groups of cells that share the same value represent the same type of geographic feature.

Multiband Raster (Image)— A raster image that has more than one value associated with it at every pixel. Each band (reference to the color band on the electromagnetic spectrum) represents a segment of the electromagnetic spectrum collected by the sensor. When displayed the image is a color composite of each band. An examples of multiband images are ortho and satellite images.

Single Band Raster (Surface)— An image with one set of values per pixel.

Image—In the software an image usually is the county data or satellite imagery scenes before any data analysis has been done. It is a representation or description of a scene, typically produced by an optical or electronic device, such as a camera or a scanning radiometer. Common examples include remotely sensed data (for example, satellite data), scanned data, and photographs.

Surface— In the software surfaces are represented by almost any type of created raster data. This include elevation, yield, application raster maps, and satellite imagery. A surface is a geographic representation of a set of continuous data (such as elevation or geological boundaries); a spatial distribution which associates a single value with each position in a plane, usually associated with continuous attributes.

Glossary

MID— MapInfo interchange format (always paired with MIF)

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SHP—A vector data storage format for storing the location, shape, and attributes of geographic features. A shape file is stored in a set of related files and contains one feature class. Shapefiles can be used to represent lines, points, or polygons. Often times you will see shape files as field boundaries, sample points, yield points, elevation, and in tile planning. Shapefiles have at a minimum of three files associated with them to make them functional. These are a SHP, SHX, and DBF. The SHP file contains the primary geographic reference data in the file. SHX file is the index portion of the file. DBF is the database file. The shapefiles attributes are stored in database format and have a columnar structure for each attribute.

CSV— Coma Separated Value files can be used as many things, similar to and Excel file. If the CSV file contains Latitude and Longitude columns it can be used as a Points—Vector file in GK desktop software.

XML— Extensible Markup Language—A markup language that defines a set of rules. These can be both human and machine readable. Textual data format, and is widely used to represent data structures.

SID— Compressed image that is created using the multi-resolution seamless image database. This is commonly used to partition large geo-referenced raster images. A common SID image is ortho imagery.

JP2— Compressed images with the metadata with XML embedded data. Geo-referenced images can be opened and displayed correctly on the earth's surface.

JPEG— Joint Photographic Experts Group—Common image compression method. Compression can be adjusted to select between size and quality of the image. Some of the original image quality is usually lost in the compression and cannot be restored. JPEG images can also support millions of different colors.

BMP—Bitmap Image File—Raster image files that can be edited, saved, geo-referenced, and used within the software. Often times they work well because they are compatible with other software packages and contain a higher resolution than a JPEG.

TIFF— Tag Image File Format— A common format for exchanging raster graphics images between application programs, including those used for scanner images. TIFF files can be composed of multiple of single bands and be georeferenced. There are many different types of TIFF file formats and not all or supported within the software. Often TIFF files will be satellite imagery scenes.

Glossary

GRD—Grid files which are used to generate maps. Most raster data created within the software is automatically saved as a GRD file. However, these files can be manually saved as a BMP, JPG, or TIFF file and maintain the geo-referencing. GRD files contain two-dimensional uniform lattices (regularly spaced, rectangular array) of XYZ data (e.g. easting, northing, and elevation); may be in a binary or text format, but is most often saved in the binary format.

NIR— Is a method of light extraction. This can be used on ortho images as well as satellite imagery. The best images to use this for are bare soil images. The NIR light is electromagnetic radiation with longer wavelengths than those of visible light, extending from the nominal red edge of the visible spectrum at 0.74 micrometers (µm) to 300 µm.

NDVI— NDVI is best used on vegetative images which can be satellite or ortho images. It gives a good measure of light reflectance on green vegetation. It is a simple graphical indicator that can be used to analyze remote sensing measurements, typically but not necessarily from a space platform, and assess whether the target being observed contains live green vegetation or not. NDVI is defined as NDVI= (NIR-VIS)/(NIR+VIS)

Geo-referenced— To define an objects location. This gives the images a position on the face of the earth.

Remote Sensing— To gather information about an object without physically being there. Most often this term is used to acquire information from aerial or satellite imagery which gives information about the field.

CSV— Common separated value. Stores data in plain text form. Can be opened in Microsoft Excel and in a text file editor (notepad). They are primarily separated by a comma. CSV files are generally used to import soil test results and yield data.

XLS— File extension used to identify the file as a Microsoft Excel file. XLS files are used when importing soil test results into the program.

GIS— Geographic Information System is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.

CIR— Refers to and Image that is “Color Inferred”. This means that there is an inferred, red, and green band in the image. However band the orders may differ between them (e.g. NRG & NGR).

NRG— An image that has an inferred, red, and green band in it, in that order.

RGB (Color)— Also referred to as a “color” or “true color” image. These images only have a red, green, and blue band in them. Since it is lacking inferred, NDVI and NIR extractions cannot be done on them.

BW— A term often seen on WMS links refers to a black and white image.